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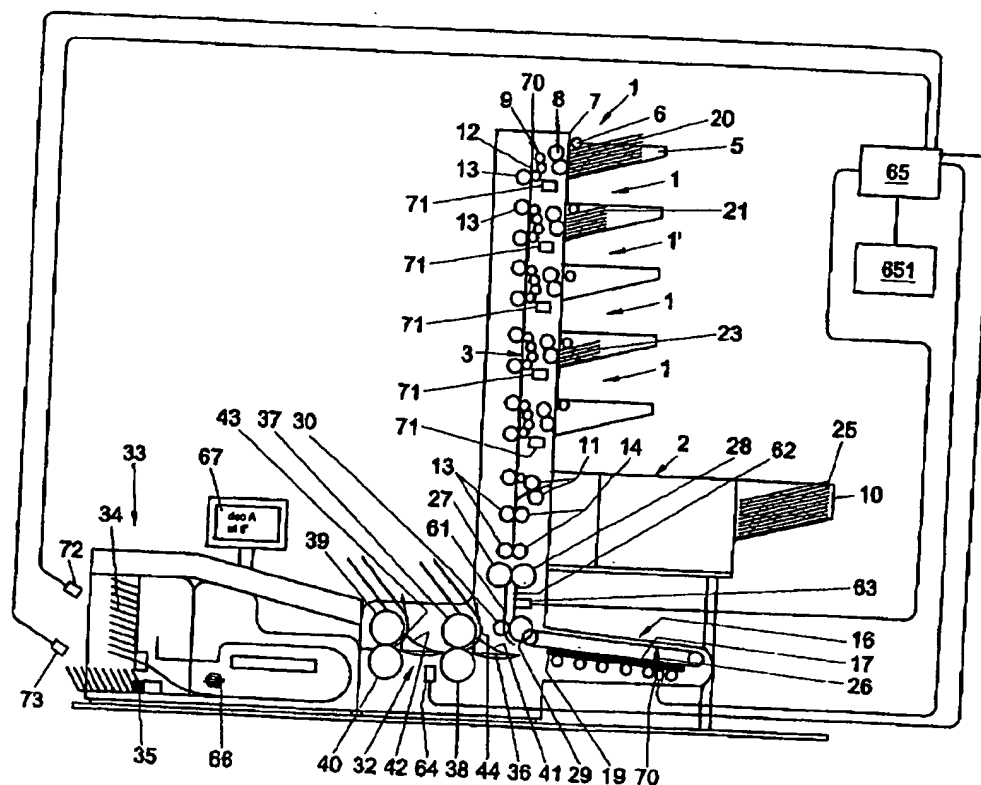
(19) **United States**(12) **Patent Application Publication**
Edens(10) Pub. No.: **US 2002/0094925 A1**(43) Pub. Date: **Jul. 18, 2002**(54) **PRODUCTION OF MAIL PIECES AND PREPARATIONS THEREFOR**

(52) U.S. Cl. 493/320

(76) Inventor: **Bertus Karel Edens, Drachten (NL)**(57) **ABSTRACT**

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For producing mail pieces in a mail production apparatus, starting from physical postal items, a required operating condition of the mail production apparatus is determined. At least one physical property to be realized manually of the required operating condition is determined and at least one current physical property of a current condition of the mail production apparatus is registered. A difference between the at least one current physical property and the at least one physical property to be realized manually of said required operating condition is determined and an associated indication is represented in humanly perceptible form. In response, the at least one current physical property is changed, such that the difference is removed. Next, with the mail production apparatus in the required operating condition, at least one mail piece is assembled from physical postal items. Also described are computer software and an apparatus for use with this method.

(21) Appl. No.: **10/032,104**(22) Filed: **Dec. 31, 2001**(30) **Foreign Application Priority Data****Dec. 31, 2000 (NL)..... 1017016****Publication Classification**(51) Int. Cl.⁷ **B31B 1/88**

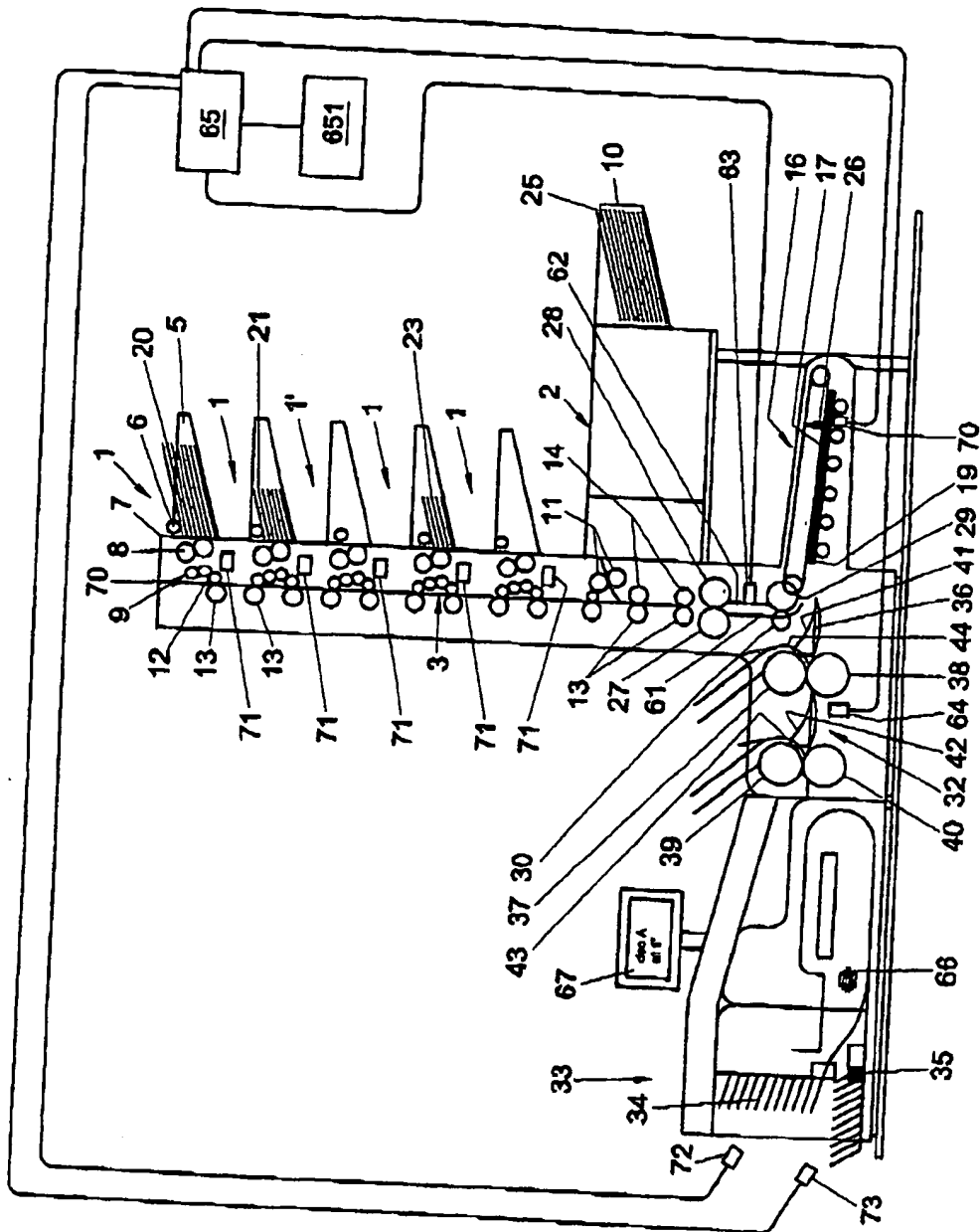


Fig. 1

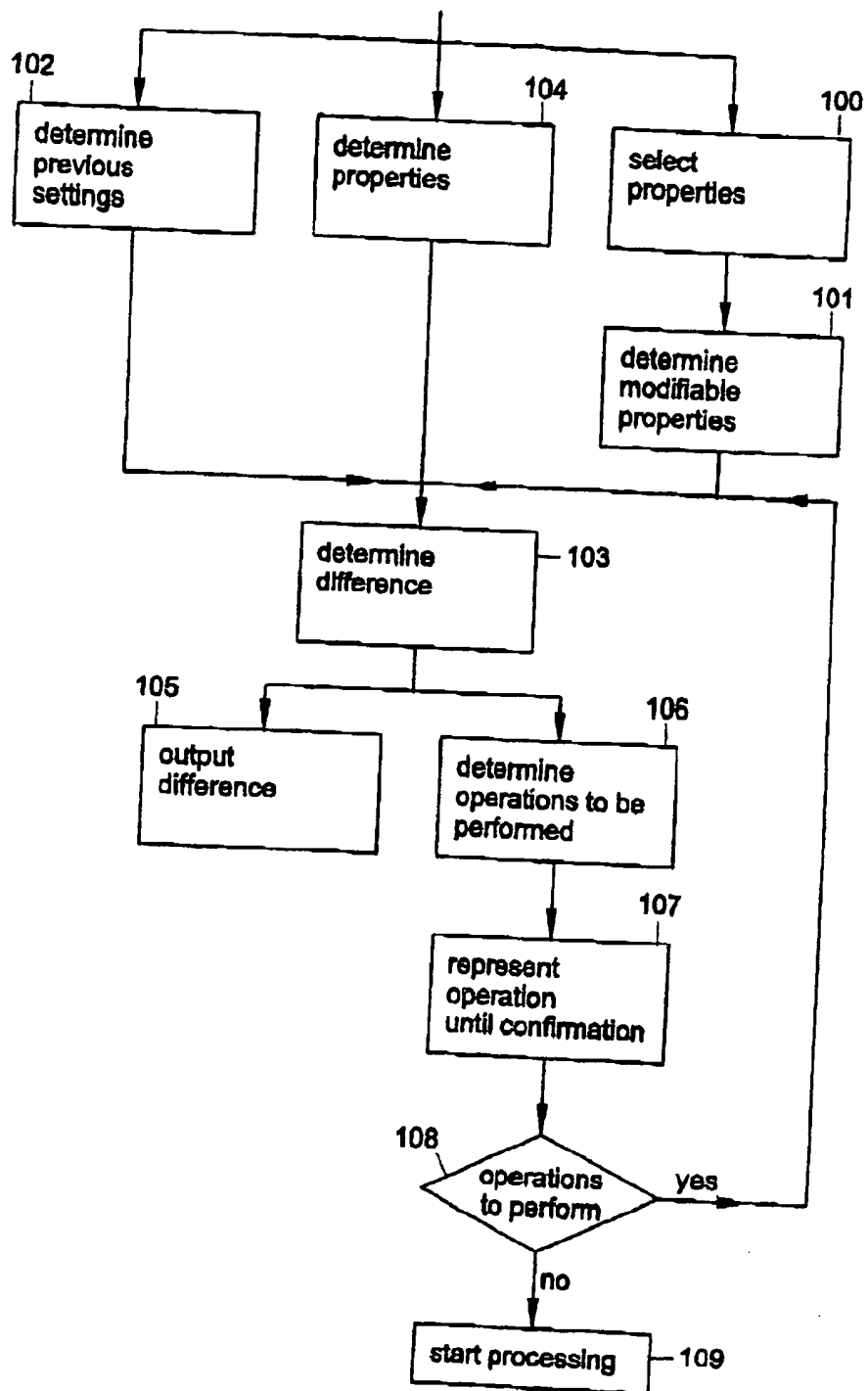


Fig. 2

PRODUCTION OF MAIL PIECES AND PREPARATIONS THEREFOR

FIELD AND BACKGROUND OF THE INVENTION

[0001] The invention relates to a method and an apparatus for producing mail pieces in a mail production apparatus, starting from physical postal items. The invention further relates to a computer program for programming an apparatus for practicing such a method.

[0002] Mail production apparatuses known from practice, of the Neopost SI-72 type, are arranged for indicating what paper lengths for producing mail pieces under a particular system setting need to be present in which feeder stations.

[0003] However, due to the mail producing apparatuses being frequently operated by temporary personnel with little experience, the problem occurs that during the preparations of the mail producing apparatus prior to the production of a mail piece or, as is more usual, a series of mail pieces under a predetermined system setting, problems arise in that the operator fails to see what needs to be done to bring the apparatus in the required condition of use, or makes mistakes.

SUMMARY OF THE INVENTION

[0004] The invention has for its object to provide a method whereby preparing a mail production apparatus is simplified and the chance of errors is reduced. To that end, the invention provides a method for producing mail pieces in a mail production apparatus, starting from physical postal items, comprising: selecting a required operating condition of the mail production apparatus applying to the production of at least one mail piece; determining at least one physical property to be realized manually of the required operating condition; registering at least one current physical property of a current condition of the mail production apparatus; determining a difference between the at least one current physical property and the at least one property to be realized manually of the required operating condition; representing an indication associated with the difference in a humanly perceptible form: manually changing the at least one current physical property, such that the difference is removed; and assembling the at least one mail piece from physical postal items with the mail production apparatus in the required operating condition.

[0005] As at least one physical property of the required operating condition that is to be manually realized is determined; at least one current physical property of a current condition of the mail production apparatus is registered; a difference between the at least one current physical property and the at least one, only manually realizable property of the required operating condition is determined; and an indication associated with the difference is represented in humanly perceptible form, the operator of the production apparatus does not himself need to determine the settings to be changed, but he can simply see what differences there are between the current condition of the apparatus and the required operating condition of the apparatus, or at least which actions are to be performed for bringing the mail production apparatus from the current condition into the required operating condition.

[0006] The invention further provides a computer program for supporting manual preparatory operations for operationalizing a mail production apparatus, comprising instructions for: determining data regarding a required operating condition applying to the production of at least one mail piece; determining at least one physical property to be realized manually of said required operating condition; registering at least one current physical property of a current condition of the mail production apparatus; determining a difference between the at least one current physical property and the at least one property to be realized manually of the required operating condition; and causing an indication associated with the difference to be represented in humanly perceptible form. In accordance with such a computer program, a mail production apparatus can be controlled for practicing the method according to the invention.

[0007] The invention further provides a mail production apparatus for producing mail pieces, starting from physical postal items, comprising: at least one finishing assembly for producing physical mail pieces; a sensor for registering a current physical property of a current condition of the at least one finishing assembly; representation means, and a control structure communicatively linked with the finishing assembly, the sensor and the representation means, the control structure being provided with code for: determining data regarding a required operating condition applying to the production of at least one mail piece; determining at least one physical property to be realized manually of the required operating condition; causing at least one current physical property of a current condition of the finishing assembly to be registered; determining a difference between the at least one current physical property and the at least one property to be realized manually of the required operating condition; causing an indication associated with the difference to be represented by the representation means; and causing the at least one mail piece to be composed by the finishing assembly in the operating condition. Such an apparatus is specifically arranged for practicing the method according to the invention.

[0008] Particularly advantageous embodiments of the invention are laid down in the depending claims.

[0009] Further details and aspects of the invention will be discussed with reference to the figures shown in the drawing.

BRIEF DESCRIPTION OF THE DRAWING

[0010] FIG. 1 is a cutaway schematic side elevation of a system according to an exemplary embodiment of the invention.

[0011] FIG. 2 is a flow diagram representing an example of a method according to the invention.

DETAILED DESCRIPTION

[0012] In the following, the invention will be further elucidated on the basis of the example of an apparatus according to the invention shown in FIG. 1.

[0013] The apparatus shown in FIG. 1 has a finishing assembly for producing mail pieces. The finishing assembly is equipped with a number of feeder stations for feeding documents. In the apparatus, these are designed as document feeder stations 1 for feeding documents 20, 21, 23. The

apparatus further comprises a printer 2 for printing sheets 25 and feeding printed sheets, and envelope feeder stations 34, 35 for feeding envelopes.

[0014] The fast feeder stations 1 are designed as document feeder stations. Each of the document feeder stations 1 has an associated tray 5 for holding insert documents to be supplied. For feeding the inserts, the feeder stations are each provided with a feed roller 6, a separation roller 7, a transport roller 8 and a pair of delivery rollers 9. An example of a separation provision suitable for use in feeder stations 1 according to the exemplary embodiment shown is described in more detail in U.S. Pat. No. 5,362,037, which is hereby referred to.

[0015] A position of the finding assembly designated 1' is empty, apart from delivery rollers serving for feed-through of documents which are to be passed from upstream feeder stations along that position 1'. At this position 1', for instance the same feeder station as the feeder stations 1 can be placed, but also a special feeder station or a station for carrying out special operations, such as stamping passing documents or providing these with a sticker, a sachet or a plastic card.

[0016] The printer 2 is provided with a tray 10 for sheets 26 to be printed and a pair of delivery rollers 11 for each time delivering a printed sheet at a suitable moment. The printer 2 is further designed and positioned such that the printing of a sheet in each case is completed before the sheet reaches a waiting position between the delivery rollers 11.

[0017] The feeder stations 1 and the printer 2 link up with a feed track 3 having a series of opposite transport rollers 12, 13, 14.

[0018] The apparatus shown further comprises an aligning station 16 for aligning documents belonging to a set and any other postal items, to form a stack having document edges substantially in alignment on one side.

[0019] The aligning station 16 is designed as a terminal station with an aligning surface 19 with a stop 26 and a discharge track 36 in line with the aligning source 19. Upstream of the aligning surface, the aligning station 16 has transport rollers 27, 28, 29, 30 and guides 61, 62. The aligning surface 19 is defined by a series of rollers.

[0020] The documents can be transported in the feeding direction as far as against the stop 26 and subsequently be discharged in the opposite direction to a folding station 32. The aligned document edges then form the trailing edge of the stack, which is advantageous in folding the stack.

[0021] Opposite the aligning surface 19, a conveyor belt 17 is arranged, which runs approximately parallel to the aligning surface 19, can exert some pressure on the aligning surface 19 and has a greater coefficient of friction relative to documents than does the aligning surface 19, which moreover is provided with rollers for further limiting the friction between documents and that surface. By driving the belt 17 in the direction of the stop 26, documents present between the aligning surface 19 and the belt 17 can be urged against the stop 26, so that the document edges are mutually aligned on the side of the stop 26.

[0022] By driving the conveyor belt 17, a document can be moved over the surface 19 as far as against the stop 26. A next document, which has been partly passed between the preceding document and the conveyor belt 17, will, moving

over the preceding document, likewise move as far as against the stop 26 when the belt 17 is driven in the direction of the stop 26. Thus, successive documents can be aligned.

[0023] The folding station 32 is provided with a first and a second pair of folding rollers 37, 38 and 39, 40, with the discharge track 36 extending between the folding rollers 37, 38 and 39, 40. Provided between the stop 26 and the folding rollers 37, 38 and 39, 40, respectively, are deflectors 41 and 42 for deflecting the edge of a stack remote from the stop 26. Opposite a folding nip between each pair of folding rollers 37, 38 and 39, 40 is a folding knife 43, 44 for pressing a deflected portion of a document or a stack of documents into the folding nip.

[0024] After alignment of the documents of a stack in the aligning station 16, the stack is first moved against the feeding direction and then to the folding station 32, whereby, at least if the stack is to be folded, the edge of the stack remote from the stop 26, and a portion of the stack contiguous thereto, is deflected along a pair of folding rollers 37, 38 or 39, 40 and the stack is subsequently pressed into a folding nip between the folding rollers 37, 38 or 39, 40 by one of the folding knives 43, 44. Thereupon the folding rollers are driven, so that a fold is provided in the stack.

[0025] A folding station and folding method of the type as described hereinabove are described in more detail in U.S. Pat. No. 4,985,013, which is hereby referred to.

[0026] Connected to the folding station 32 is an inserter station 33. This inserter station 33 is equipped with two trays 34, 35 for envelopes. What can serve as a basis for such an inserter station is an inserter station described in more detail in the European patent application having publication no. 0781671. The inserter station has an envelope track 4 and an exit 18 for packaged mail pieces

[0027] At the beginning of the setting and production operation represented in FIG. 2, first, in a setting phase, during a selection step 100, one or more properties of the finishing assembly are determined which are associated with the series of mail pieces to be produced. These can be, for instance: the inserts 20, 21, 23 needed for the mail pieces, and their positions, the required type of sheets 25 to be printed, required type(s) of envelopes, the number of required feeder stations, the settings of the folding station, the position of the stop 26, the presence of special stations at the position 1', the presence of a framing unit, etc.

[0028] The properties can have been priorly determined and subsequently stored in a memory 651 linked with a control unit 65 of the finishing assembly. At the start of the operation, a set of properties (also referred to as job setting) that apply to the production of a mail piece or, as is more usual, a series of mail pieces, is selected from the memory by a user. If the properties of the finishing assembly for the kind of mail piece to be produced have not been priorly determined, the properties can, after being inputted, be stored in the memory 651, so that in a next production operation of the same kind of mail pieces the data regarding the required set of properties can be readily retrieved again. Determining the properties of the finishing assembly that are desired for a series of mail pieces and inputting the data involved in the memory can be done by third person, not being an operator, for instance a technician of the manufacturer or a specially trained employee.

[0029] After a set of properties has been established, the control unit 65, in determining step 101, determines the physical properties thereof that are to be changed manually. It will be clear that automatically modifiable properties of the finishing assembly can be automatically modified under the control of the control unit 65. The properties to be modified manually, however, must be adapted by the operator. Automatically modifiable properties are known per se and are therefore not discussed for the sake of brevity. The properties to be changed manually can be, for instance: the types of document that must be present in the respective feeder stations 1, the presence of a particular type of station at the position 1' and downstream of the inserter machine 33, the size of the sheets 25 to be printed, the position of the stop 26 and the kind of envelopes that must be present in the envelope feeder stations 34, 35.

[0030] After determination step 101, the control unit 65, in step 103, determines the difference between the selected manually modifiable properties and current properties of a current condition of the finishing assembly. To that end, first, in step 104, the current properties of the current condition of the finishing assembly are registered. To that end, the apparatus is provided with sensors 63, 64, 70-73 linked with the control unit 65, which sensors can measure the quantities relevant for the respective property and, on the basis thereof, can provide signals that represent the respective properties to the control unit 65. As a result, the control unit 65 can determine the difference between the current condition and the required properties.

[0031] It is also possible, however, to determine the current properties relying on the set of properties that applied to the preceding production operation (step 102). The data regarding the set of properties that applied during the preceding production operation are stored in the memory 651 and can be retrieved therefrom by the control structure 65 and be compared with the properties determined. Determining the difference between the current condition and the required properties can thus also be done without actual observations, so that sensors can be saved.

[0032] For determining postal items present in the feeder stations 1 and sheets present in the printer 2, a scanner 63 is arranged along the transport track 3, downstream of the feeder stations 1 and the printer 2. The stations 1 and the printer are controlled one by one to feed an item, and these are scanned by the scanner 63. Thus, only one scanner can suffice for scanning items from all stations 1 and the printer 2. For observing envelope types in stations 34, 35, sensors 72, 73 are provided. In the embodiment shown in FIG. 1, the sensors 72, 73 are designed as digital cameras which can make a recording of the upper side of a stack of envelopes. The recording made by the cameras is then inputted into the control unit 65 and compared with images of postal item types as stored in the memory 651, so that the item type present can be determined and compared with the item type according to the required properties.

[0033] In FIG. 1, further sensors 71 in the form of connections with several electrical contact points are placed which can each detect the presence of a feeder station in the respective position and, on the basis of a signal received via the contact points, can further identify the type of feeder station. At the stop 26 a sensor 70 is present which deter-

mines the position of the stop, and the folding station is provided with a detector which can detect the position of deflectors 41, 42.

[0034] After in step 103 the difference between the required properties and the current properties has been determined, the difference determined is represented in representation step 105. Such representation can be done in any humanly perceptible form. According to this example, the difference is represented on a display 67. It is also possible, however, to provide the control structure 65 with a speech module and to communicate the difference to the operator by way of speech via a loudspeaker 66. Communication to the operator is then also possible without the operator being in the immediate vicinity of the display 67, which enables faster filling of the trays 5, 10, because the operator does not need to look at the display all the time. As the difference between the current condition and the properties to be changed is displayed, the operator can readily see what operations he must perform to bring the apparatus in the condition required for the mail piece to be produced. The operator thus does not himself need to determine the differences and the operations to be performed, but only needs to adjust the differences displayed, so that the risk of errors is reduced. As performing manual settings is thus simplified, also the necessity of automatic setting is rendered less urgent. As a consequence, without serious disadvantage, actuators for automatic setting can be saved upon.

[0035] The finishing assembly, depending on the setting of the finishing assembly selected by the operator, can also determine which operations are to be performed for removing the differences established in step 103 (step 106) and display the operations to be performed (step 107). A combination of representation step 105 and determining and representing the operations to be performed is also possible. In that case, for instance, the difference is depicted on a display in the form of an image of the apparatus with the differences highlighted and the operations to be performed represented in a table next to the image.

[0036] It is also possible in each case to represent only a portion of the operations to be performed in the step 107 and subsequently, in a step 108, to determine whether any further operations are to be performed and, if so, to represent a next one of residual operations. As a result, it is checked in each case whether the operator has performed the operation, or at least has reported it as performed, and the operator only needs to remember and perform the step represented.

[0037] The operator's chief actions are filling the feeder stations 1 and the envelope feeder stations 34, 35 with the correct postal item types, such as documents, inserts and envelope types. To prevent errors in this regard, in representing the operations to be performed, the item types to be loaded can be represented. To further reduce the risk of errors, also the feeder station where a specific document type is to be entered can be represented. Such representation can be effected, for instance, by depicting a property of the item type on the display 67. This property can be, for instance, the appearance of the front of the document, a title of the document, an identification code of the document, the size of the document or the kind of paper of the document.

[0038] After difference step 103 and the representation step 105 and/or steps 106, 107 have been carried out, the current properties, as far as necessary, can be modified into

the required properties, and with the production apparatus mail pieces can be produced with the system settings determined.

What is claimed is

1. A method for producing mail pieces in a mail production apparatus, starting from physical postal items, comprising:

selecting a required operating condition of the mail production apparatus applying to the production of at least one mail piece;

determining at least one physical property to be realized manually of said required operating condition;

registering at least one current physical property of a current condition of said mail production apparatus;

determining a difference between said at least one current physical property and said at least one property to be realized manually of said required operating condition;

representing an indication associated with said difference in a humanly perceptible form;

manually changing said at least one current physical property, such that said difference is removed; and

composing said at least one mail piece from physical postal items with said mail production apparatus in said required operating condition

2. A method according to claim 1, wherein at least one property of said current condition is determined by determining at least one property of a directly preceding operating condition.

3. A method according to claim 1, further comprising:

determining operations to be performed manually for bringing said mail production apparatus from said current condition into said required operating condition; and

4 representing said operations to be performed manually in a humanly perceptible form.

4. A method according to claim 3, further comprising:

each time after an operation has been performed, again register the current condition of said mail production apparatus; and

representing in humanly perceptible form at least one residual operation of said operations to be performed.

5. A method according to claim 1, further comprising determining types of physical postal items associated with said required operating condition;

registering physical postal items loaded into said mail production apparatus;

determining a physical postal item type of said loaded physical postal items; and

determining a difference between types of physical postal items associated with said required operating condition and said types of loaded physical postal items;

wherein representing said difference comprises representing at least one type of physical postal items to be loaded.

6. A method according to claim 5, further comprising representing at least one loading position for physical postal items of said at least one type that are to be loaded.

7. A method according to claim 6, wherein representing said at least one type of physical postal item types to be loaded is carried out by representing a property of physical postal items of said at least one type that are to be loaded.

8. A method according to claim 7, wherein loaded physical postal items are registered by said mail production apparatus by scanning and registering a property of each of the types of loaded physical postal items.

9. A computer program for supporting manual preparatory operations for operationalizing a mail production apparatus, comprising instructions for:

determining data regarding a required operating condition applying to the production of at least one mail piece;

determining at least one physical property to be realized manually of said required operating condition;

registering at least one current physical property of a current condition of said mail production apparatus;

determining a difference between said at least one current physical property and said at least one property to be realized manually of said required operating condition; and

causing an indication associated with said difference to be represented in a humanly perceptible form.

10. An information carrier provided with machine-readable data constituting a computer program according to claim 9.

11. A mail production apparatus for producing mail pieces, starting from physical postal items, comprising:

at least one finishing assembly for producing physical mail pieces;

a sensor for registering a current physical property of a current condition of said at least one finishing assembly;

representation means; and

a control structure communicatively linked with said finishing assembly, said sensor and said representation means, said control structure being provided with code for:

determining data regarding a required operating condition applying to the production of at least one mail piece;

determining at least one physical property to be realized manually of said required operating condition;

registering at least one current physical property of a current condition of said finishing assembly;

determining a difference between said at least one current physical property and said at least one property to be realized manually of said required operating condition;

causing an indication associated with said difference to be represented by the representation means; and

causing said at least one mail piece to be composed by said finishing assembly in said operating condition.

12. An apparatus according to claim 11, further comprising a memory structure communicatively linked with said control structure for storing data which represent a directly preceding operating condition, wherein said control structure is further arranged for determining at least one property of said current condition by determining at least one property of said directly preceding operating condition.

13. An apparatus according to claim 11, wherein said control structure is further arranged for determining operations to be performed manually for bringing said finishing assembly from said current condition into said required operating condition and representing said operations to be performed with said representation means in humanly perceptible form.

14. An apparatus according to claim 13, wherein said control structure is further arranged for registering the current condition again after the performance of one of said operations to be performed and representing in humanly perceptible form at least one residual operation of said operations to be performed.

15. An apparatus according to claim 11, further comprising an item sensor communicatively linked with said control

structure, for registering loaded physical postal items, wherein said control structure is further arranged for determining physical postal item types associated with said required operating condition, registering loaded physical postal items, determining at least one type of said loaded physical postal items; and representing at least one type of physical postal items to be loaded.

16. An apparatus according to claim 15, wherein said control structure is further arranged for representing with said representation means, in addition to the or each type of physical postal items to be loaded, a loading position for physical postal items of that type to be loaded.

17. An apparatus according to claim 15, wherein said control structure is further arranged for representing a property of physical postal items of said type to be loaded,

18. An apparatus according to claim 16, wherein said item sensor is arranged for registering an item property of said loaded physical postal items.

* * * * *

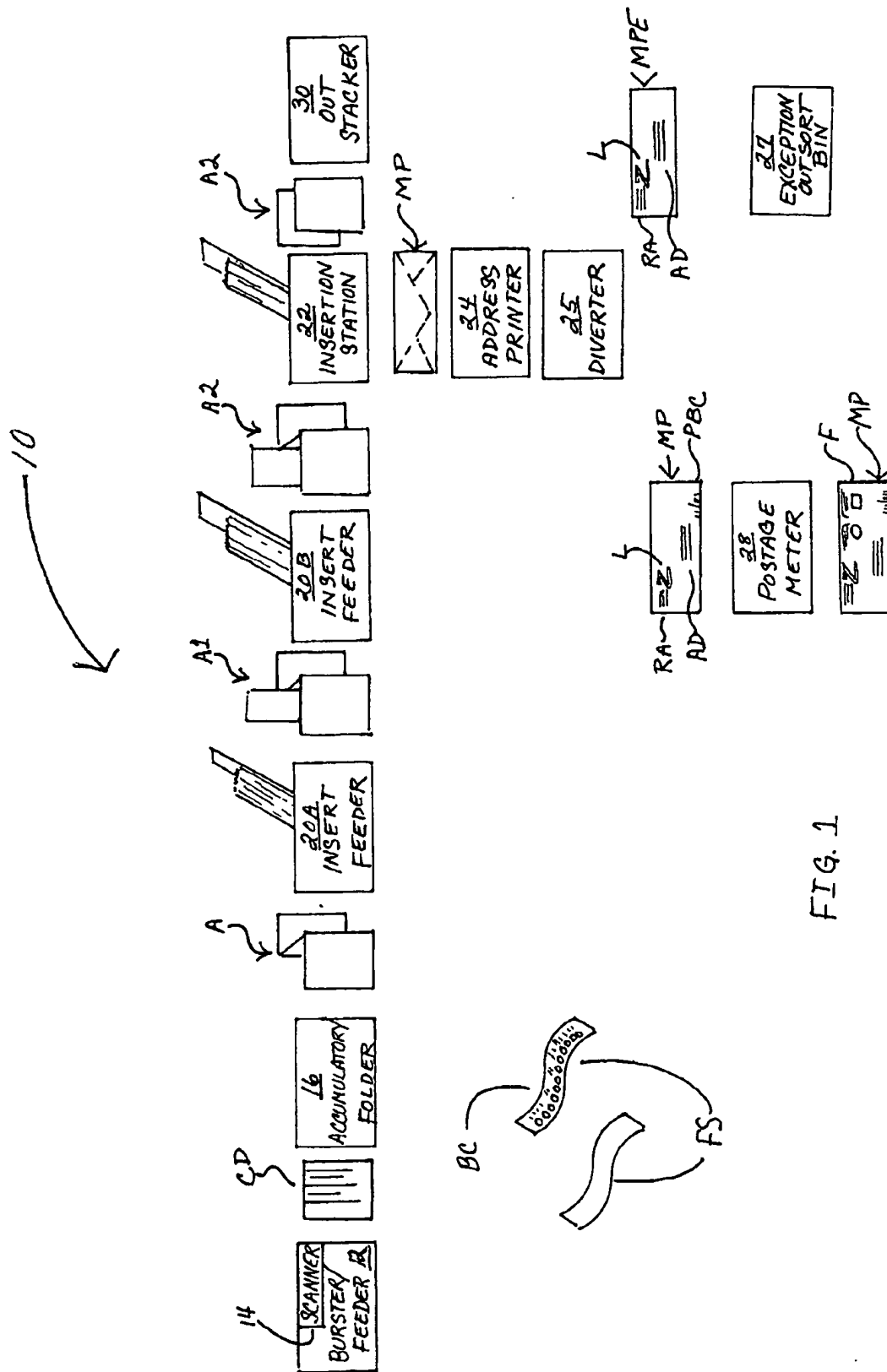


FIG. 1

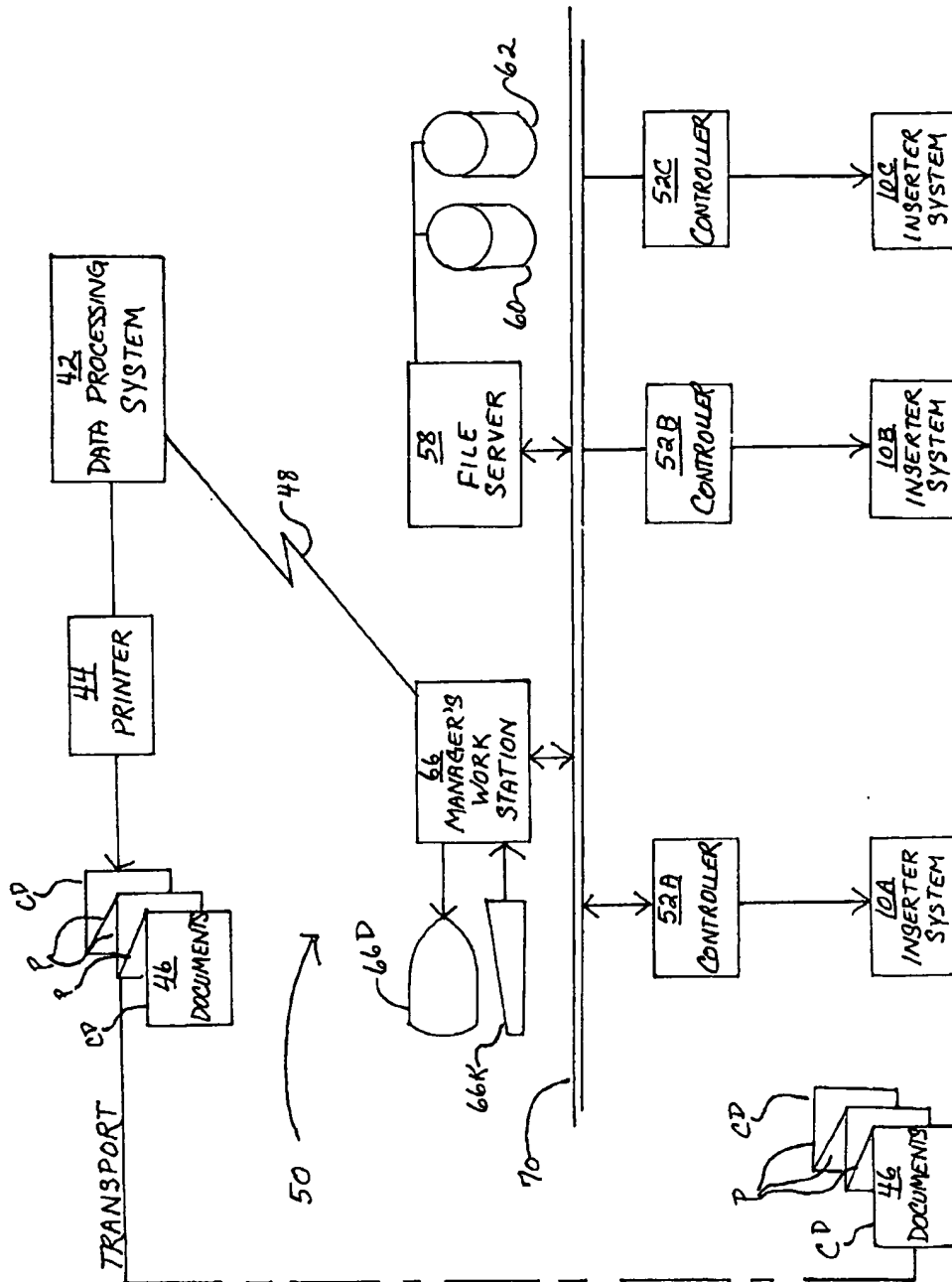


FIG. 2

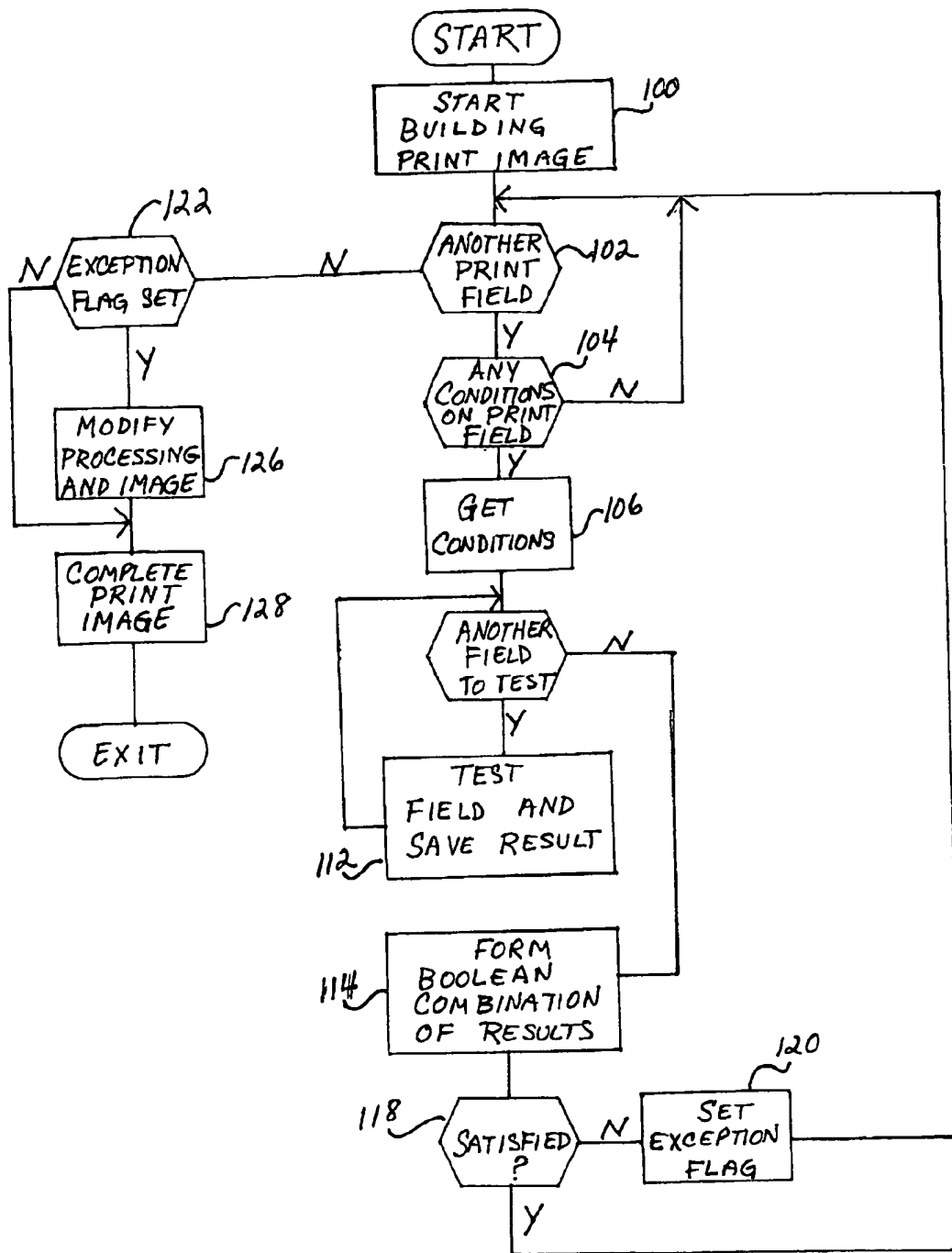


FIG. 3

**METHOD AND SYSTEM FOR PREPARATION OF
MAILPIECES HAVING A CAPABILITY FOR
PROCESSING INTERMIXED QUALIFIED AND
NON-QUALIFIED MAILPIECES**

BACKGROUND OF THE INVENTION

[0001] This invention relates to the preparation of large mailings and the like. More particularly it relates to systems and apparatus for the preparation of documents and the assembly of multiple mailpieces including such documents.

[0002] The term "mailpieces" as used herein means items intended to be delivered by a postal service or private courier service. Typically preparation of mailpieces includes, but is not limited to, printing or otherwise providing documents including variable information pertaining to addressees of the mailpieces and the assembly of such documents with other elements of the mailpiece. The term "assembly" as used herein means the execution of actions to incorporate the documents into mailpieces. Typically, such actions can include: accumulating documents with other materials such as preprinted inserts, folding and inserting the resulting accumulations into envelopes, printing addresses and other information on the outside of the envelopes, and franking the mailpiece with an appropriate postage amount.

[0003] Inserter systems for the preparation of mailpieces are well known. Such systems receive documents which have been preprinted, typically by a data processing system, accumulate documents associated with particular mailpieces, add inserts to the accumulation, and insert the accumulation into an envelope. Known inserter systems can also print the mailpiece envelope with an address as well as other information and can frank the mailpiece with a postal indicia for the appropriate amount of postage. Such systems operate at high speeds, on the order of thousands of mailpieces per hour, and with low error rates, and are essential for production of modern mass mailings.

[0004] While systems such as those described above have proven highly successful, certain disadvantages remain. Modern inserter systems operate at extremely high processing rates which require that documents, inserts and envelopes all be moved and handled at high speeds. In such systems it is difficult to identify mailpieces which require special handling. In particular it has proven difficult to intermix qualified and non-qualified mail in a single mailing job. ("Qualified" mail is mail which qualifies for special discounted postal rates because it has been pre-sorted and processed in accordance with strict postal service requirements.) It is desirable to intermix qualified and non-qualified mail pieces since, for example, constraints in the mail generation software may make it necessary or desirable to merge two mailing lists where one list is qualified and the other is not. However it is critical that such a mailing not be delivered to the Postal Service with qualified and non-qualified mail intermixed since the Postal Service will reject such mail.

[0005] Another, related problem is the occasional need to make modifications to the material printed on particular mailpieces within a job. For example a "Postnet" barcode should not be printed on a non-qualified mail piece; or a user may find that certain messages or slogans are not well received in certain cities and/or states. Heretofore mail for such places would have to be handled as a special job. Such

a special job would of course be a source of delay, and would also increase the likelihood of misprocessed mailpieces.

[0006] Thus it is an object of the subject invention to provide a system and method for the preparation and assembly of mailpieces which has increased flexibility for handling of intermixed mailpieces and of mailpieces which require modification of what is to be printed on the mailpiece envelope.

BRIEF SUMMARY OF THE INVENTION

[0007] The above object is achieved and the disadvantages of the prior art are overcome in accordance with the subject invention by means of a method and apparatus for method for processing of a mailing by a mail preparation system, where an inserter system or the like assembles said mailpieces, the inserter system including a programmable controller programmed to control assembly of the mailpieces in accordance with information included in a mailpiece record, such assembly including causing at least one print field to be printed on an envelope for said mailpiece. The system stores a predetermined Boolean combination of predetermined tests of at least one field of the mailpiece records. The programmable controller controls the inserter system to assemble said mailpieces in accordance with the information in the mailpiece record and, for each of the mailpieces, prior to printing the print field, determines if said Boolean combination is satisfied; and if it is not satisfied, diverts the mailpiece.

[0008] In accordance with one aspect of the subject invention, a plurality of said fields of said mailpiece records are tested.

[0009] In accordance with another aspect of the subject invention, printing of said print field is modified if said Boolean combination is not satisfied.

[0010] In accordance with another aspect of the subject invention, said print field is suppressed if said Boolean combination is not satisfied.

[0011] In accordance with another aspect of the subject invention, a predetermined string of alphanumeric characters is appended to said print field if said Boolean combination is not satisfied.

[0012] In accordance with another aspect of the subject invention, the diverted mailpiece is processed as non-qualified mail.

[0013] In accordance with another aspect of the subject invention, the print field includes a barcode representation of address information.

[0014] In accordance with still another aspect of the subject invention an inserter system or the like assembles said mailpieces, the inserter system including a programmable controller programmed to control assembly of the mailpieces in accordance with information included in a mailpiece record, such assembly including causing at least one print field to be printed on an envelope for said mailpiece. The system stores a predetermined Boolean combination of predetermined tests of a plurality of fields of the mailpiece records. The programmable controller controls the inserter system to assemble said mailpieces in accordance with the information in the mailpiece record and, for each of the mailpieces, prior to printing the print field, determines if

the Boolean combination is satisfied; and if it is not satisfied, modifies further processing of the mailpiece.

[0015] In accordance with another aspect of the subject invention, processing of the mailpiece is modified by modifying the print field.

[0016] In accordance with another aspect of the subject invention, processing of the mailpiece is modified by suppressing the print field.

[0017] In accordance with another aspect of the subject invention, processing of the mailpiece is modified by appending a predetermined string of alphanumeric characters to the print field.

[0018] Other objects and advantages of the subject invention will be apparent to those skilled in the art from consideration of the detailed description set forth below and the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] FIG. 1 shows a schematic block diagram of an inserter system suitable for use in accordance with the subject invention.

[0020] FIG. 2 shows a schematic block diagram of a system for preparing mailpieces.

[0021] FIGS. 3 shows a flow diagram of the operation of the system of FIG. 2.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE SUBJECT INVENTION

[0022] An inserter system suitable for use in accordance with the subject invention is shown in FIG. 1. Inserter system 10 includes burster/feeder 12 which inputs preprinted documents in fanfold form, separates the documents and removes and discards sprocket feed strips FS from the edges of the document. Each group of documents for a particular mailpiece includes at least control document CD. On control documents CD strips FS are marked with code BC which is read by scanner 14 before strips FS are removed. In simpler systems code BC can be a "dash code" of the type known for use in directly controlling inserter systems. In newer, more complex systems code BC can be a conventional bar code which serves as a pointer to a mailpiece record which record contains information for controlling the inserter; as will be more fully described below. In other known inserter systems, a cut sheet document feeder can be used in place of burster/feeder 12 and documents can be in cut sheet form.

[0023] Control document CD, and any additional associated pages P are fed from burster feeder 12 to accumulator 16 where documents for each mailpiece are formed into separate accumulations A and folded.

[0024] Accumulation A is then fed to insert stations 20A and 20B where preprinted inserts I are added to form accumulations A1 and A2. Those skilled in the art will of course recognize that the number of such insert stations used will vary from application to application.

[0025] Accumulation A2 is then fed to insertion station 22 where it is inserted into an envelope and sealed to form mailpiece MP.

[0026] Mailpiece MP is then fed to address printer 24 which prints address AD on the outside of the envelope. Depending on the size of the print field of printer 24, printer 24 also can be used to print other information such as a variable return address (or other text message) RA, logo L, and postal barcode PBC (a barcode including address information such as an address zip code) on the envelope. (Those skilled in the art will recognize that dash codes as described above typically cannot include sufficient information to define even address AD so that systems incorporating dash codes typically use window envelopes to provide addressing information.)

[0027] The above described mailpiece assembly operations are well known and need not be described further here for an understanding of the subject invention.

[0028] In accordance with the subject invention, after a mailpiece is printed it can be diverted as an exception by conventional diverted 25 to exception outsort bin 27 based upon testing of selected fields of the mailpiece record, as will be described further below. In a preferred embodiment of the subject invention exceptions MPE can be non-qualified mailpieces which are intermixed with qualified mailpieces. Preferably, postal barcode PBC will be suppressed on exceptions MPE.

[0029] Undiverted mailpiece MP is then franked with postal indicia F in an appropriate amount by postage meter 28 in a conventional manner.

[0030] System 10 also includes outstacker 30 for diverting mailpieces when an error is detected prior to printing of an address.

[0031] As noted above, inserter systems wherein said code BC is a barcode which is used as a pointer to a mailpiece record (i.e. an electronic record associated with a mailpiece to be assembled) are known. By incorporating data for controlling assembly of mailpieces in mailpiece records an essentially unlimited amount of data can be associated with each mailpiece. Thus addresses, return addresses, logos, and postal bar codes can all readily specified in addition to specification of the number of inserts to be added at each insert feeder, postage amounts, etc. Systems incorporating such mailpiece records are described in commonly assigned U.S. Pat. No. 4,800,505; to: Axelrod et al.; for: "MAIL PREPARATION SYSTEM"; issued Jan. 24, 1989, which is hereby incorporated by reference. Embodiments of the system of U.S. Pat. No. 4,800,505 are marketed by the assignee of the present application under the name "Direct Connection", described in *The Direct Connection*, version 1.30.

[0032] A typical mail piece record (hereinafter sometimes MRDF record) which is associated with a mailpiece to be processed is shown in Table 1 below.

TABLE I

MRDF Record		
Start	Length	Description
1-60	60	Full Name
61-120	60	Address 1
121-180	60	Address 2
181-240	60	Address 3
241-300	60	Street (Primary)

TABLE I-continued

MRDF Record		
Start	Length	Description
301-328	28	City
329-344	15	State
345-349	5	Zip 5
350-353	4	Zip + 4
354-355	2	Zip + 2
356-360	10	Carrier Route
361-362	2	Presort Type (EC/CC/P/R)
363-372	10	Sequence # (Piece ID)
373-379	7	Job ID
380	1	Break 1 Flag (Y/N)
381-382	2	Outsort (Bin #)
383	1	Sealer (Y/N)
Total Length	383	

[0033] In the record shown in Table 1, bytes 1-60 specify the addressee's name; bytes 61-240 specify 3 lines of additional addressee information such as additional addressees, titles, etc.; bytes 241-344 specify the address; bytes 345-355 specify the Zip Code with either a two or four digit extension; bytes 356-360 specify a carrier route; bytes 361-362 identify the type of presorting which has been carried out for the mailing; bytes 363-372 specify the mailpiece ID, which increases or decreases by one, monotonically for each mailpiece; bytes 373-379 specify the job or mailing in process, and with the mailpiece ID uniquely identify the mailpiece; byte 380 flags a break in the mailing; bytes 381-382 specify an outsort bin so as to identify a particular bin as exception outsort bin 27 or to control further sorting down stream (not shown); and byte 383 specifies whether or not the mailpiece is to be sealed. (Though not shown in FIG. 1, sealers are conventional in inserter systems.)

[0034] Other information which can be included in MRDF records can be information such as messages or return addresses or specification of the number of inserts to be added at each insert station. In general the information and format of MRDF records is limited only by the system capabilities.

[0035] FIG. 2 shows mail preparation system 40 which includes data processing system 42 and mailpiece assembly system 50.

[0036] Data processing system 42 is programmed in a conventional manner to generate documents 46, which include control documents CD and associated documents P; with one control document CD and its associated documents P being associated with each mailpiece, wherein control documents CD are marked with barcode pointers to mailpiece records in the manner described above. In the embodiment shown, system 42 controls printer 44 to print documents 46 directly and documents 46 are transported physically for assembly; however, any convenient method of output and transport, such as electronic output and transmission for remote printing, can be used and is within the contemplation of the subject invention.

[0037] Data processing system 42 also generates and outputs a mailing control file, (hereinafter sometimes mail run data file, or MRDF) which includes a plurality of

mailpiece records, in a conventional manner. The mailpiece records each include a plurality of fields containing data for controlling assembly of the mailpiece. The mailing control file is communicated to mailpiece assembly system 50 through communications link 48, which can utilize any convenient form of communication, such as electronic data communication or the physical transfer of media without departing from the scope the subject invention.

[0038] In the embodiment shown in FIG. 2, mailpiece assembly system 50 includes inserter systems 10A, 10B, and 10C, which are substantially similar to conventional inserter system 10 described above with reference to FIG. 1, of the type wherein control documents CD include a barcode pointer to a mailpiece record.

[0039] Mailpiece assembly system 50 also includes controllers 52A, 52B, and 52C for controlling operation of inserter systems 10A, 10B, and 10C in a manner which will be described more fully below.

[0040] Mailpiece assembly system also includes file server 58 which manages MRDF data store 60 which stores mailing control files downloaded from data processing system 42, and which also communicates appropriate mailing control files to controllers 52A, B or C as mailings are assigned to inserter systems, as will be more fully described below. Server 58 also controls data store 62 which stores configuration information such as logos to be printed on mailpieces, print fonts to be used and other common information used generally in the production of a mailing job. In accordance with the subject invention, data store 62 also stores conditions, or tests, on fields of the mailpiece record which condition assembly of the mailpiece, as will be further described below (Data stores 60 and 62 are preferably stored on a common storage device but are shown separately for ease of illustration. In general such data stores can be maintained on any device or system which is conveniently accessible without departing from the scope of the subject invention.)

[0041] Mailpiece assembly system also includes manager's workstation 66, which includes display 66D and keyboard 66K through which a site manager can access and edit data stores 60 and 62 and can assign mailings to various inserter systems.

[0042] Communications among workstation 66, file server 58 and controllers 52A, B and C is preferably carried out over conventional local area network 70 in a manner well understood by those skilled in the art and which need not be discussed further for an understanding of the subject invention.

[0043] Turning to FIG. 3, a high level flow diagram of the operation of mail preparation system 40 in accordance with the method of the subject invention is shown.

[0044] Initially, as described above with respect to FIG. 2, data processing system 42 generates document sets 46 for a mailing. Each of sets 46 corresponds to a particular mailpiece and includes a control document CD and any associated pages P. Each of control documents CD includes coded information which is used by one of controllers 52A, 52B, or 52C to control corresponding inserter system 10A, 10B, or 10C (hereinafter assumed to be controller 52A and system 10A) to assemble the corresponding mailpiece. At 102 the document sets are transported to inserter system 10A. In the

embodiment shown, documents are printed locally by printer 44 and physically transported to system 10A, but in other preferred embodiments the documents can be generated in any convenient manner such as on portable magnetic media, or by electronic transmission for remote printing. Data processing system 42 also downloads an MRDF to data store 60 through file server 58. As described above the MRDF comprises mailpiece records defining assembly of each mailpiece MP in the mailing, as is well known in the art, and control documents CD include barcode pointers identifying corresponding records in a similarly well known manner.

[0045] (While in the embodiment shown in FIG. 3A only a single mailing is described, for clarity of description, those skilled in the art will recognize that in many embodiments multiple mailings can be in process at one time.)

[0046] When document sets 46 reach inserter system 10A documents 46 are input in sequence, mailpiece identification numbers are read at, and the MRDF in data store 60 is accessed to read the corresponding mailpiece record. System 10A then processes mailpiece MP through insertion of documents 46, together with any specified inserts I, into envelope E in accordance with the mailpiece record, as described above. Such initial assembly operations are well known to those skilled in the mailing art and need not be discussed further for an understanding of the subject invention. Such initial assembly operations are described in above mentioned US Pat. No.: 4,800,505 and commonly assigned, co-pending U.S. patent application Ser. No.: 09/134977; for: "METHOD AND SYSTEM FOR REGENERATION OF MISPROCESSED MAILPIECES OR THE LIKE", filed: Aug. 14, 1998; by: Bodie (E-765) which are hereby incorporated by reference.

[0047] (Those skilled in the art will recognize that inserter systems as shown in FIG. 1 comprise a series of stations through which partially completed mailpieces MP progress

[0049] Initial configurations can be specified in any convenient manner without departing from the scope of the subject invention. In one embodiment initial configuration information is specifically coded and input for a mailing. In another embodiment various configurations are stored in a data base and accessed in accordance with pointers in the MRDF. Such data bases are described in commonly assigned, co-pending U.S. patent application Ser. No.: 09/124501; for: "SYSTEM, METHOD AND APPARATUS FOR PREPARATION MAILPIECES"; filed: Jul. 29, 1998; by: Hart (E-750).

[0050] At 102 controller 52A tests to determine if there are any more print fields to be processed. If there are, at 104 it determines if there are any conditions on the print field and, if not, returns to 102. Otherwise, at 106 conditions for the active print field are accessed.

[0051] Conditions on various print fields are specified during initial configuration for a mailing, as described above. Such conditions specify particular Boolean combinations of particular tests of the contents of selected fields in the mailpiece record and actions to be taken if the Boolean conditions are not satisfied.

[0052] In a preferred embodiment of the subject invention conditions on a "Postnet" print field are used to distinguish non-qualified mail which is intermixed with qualified mail. This field contains a "Postnet" barcode representation of the Zip code for a mailpiece as specified in the mailpiece record. Qualified mail includes mail which has been appropriately presorted and printed with a "Postnet" barcode specifying an extended seven or nine digit Zip code. Mailpiece records for qualified mail will have a string "EC", "CC", or "R" in the Presort Type field and will have non-zero values for either the Zip+2 field or the Zip+4 field. An example of a condition on the "Postnet" field which will cause non-qualified mail to be outsourced and will suppress printing of the Postnet barcode is:

FOR (Postnet)	print field
IF (Presort Type = "EC" or "CC" or "R")	test 1st mailpiece record field
AND ((Zip + 2 not = 0) OR (Zip + 4 not = 0))	test 2d mailpiece & 3rd record fields/form Boolean combination/test combination
THEN (Print Postnet)	mailpiece qualified
ELSE (Suppress Postnet, Divert)	mailpiece non-qualified

in sequence as they are processed. Thus, though operations of inserter 10A are shown with respect to a single mailpiece MP for simplicity and clarity of description, those skilled in the art will recognize that controller 52A is programmed to concurrently control assembly of all of mailpieces MP being processed by system 10A at any one time.)

[0048] At 100 system 10A begins to build a print image to be printed on envelope E of mailpiece MP in a conventional manner and as specified during the initial configuration of system 10A for the mailing. The print image comprises fixed print fields which are defined during initial configuration and are printed on all mailpieces MP (unless suppressed, as will be described further below), and variable print fields whose content is defined by the mailpiece record for each of mailpieces MP.

[0053] (The above example is illustrative and is not intended to represent actual requirements of the USPS.)

[0054] It will be readily apparent that conditions as described above can encompass all Boolean combinations of tests on the contents of specified mailpiece record fields, including string matches and arithmetic tests.

[0055] Also it should be noted that the subject invention is not limited to embodiments where exceptions are diverted. For example assume that the Springfield Massachusetts Little League team defeated The Springfield Illinois team to win the Little League World Series and that the mailer wishes to print congratulations on the mailpiece envelopes. Such a message might be misunderstood outside Massachusetts and resented in Springfield Illinois. Printing of a "Message" print field might be conditioned as follows:

[0056] FOR: (Message)

[0057] IF (City="Springfield")

[0058] AND (State="Massachusetts" or "Mass" or "MA")

[0059] THEN (Print "CONGRATULATIONS TO OUR SPRINGFIELD CUSTOMERS ON YOUR VICTORY")

[0060] ELSE (Suppress Message)

[0061] It will be apparent from the above example that conditions on multiple mailpiece record fields allow a precession of control of mailpiece assembly unavailable in the prior art.

[0062] (A "Direct Connections" production mail system having a capability to suppress printing of a print field based on the content of a single MRDF field has been marketed by the assignee of the present application more than one year prior to the filing date of the present application. However the capabilities of this system were limited in that only single field could be tested; thus the marketed system could not distinguish between Springfield Mass. and Springfield Ill. Further, the marketed system could not handle intermixed qualified and non-qualified mail.)

[0063] Returning to FIG. 3, at 110 controller 52A determines if there is another mailpiece record field test specified in conditions on the current print field. If there is, at 112 the specified test is conducted and the results are saved and the system returns to 110. When all fields specified have been tested, at 114 the specified Boolean combination of results is formed and tested at 118. If the combination is not satisfied the appropriate exception flag is set and the system returns to 102. If the combination is satisfied the system returns to 102 directly.

[0064] (It will be apparent to those skilled in the art that the choice of which mailpieces MP are classified as exceptions MPE is arbitrary; depending on whether a particular Boolean combination or its negation is specified.)

[0065] When all print fields have been examined for specified conditions, the system goes to 122 to determine if any exception flags have been set. If any exception flags are set, at 126 further processing is modified (e.g. by setting diverted 25 to divert exception MPE to bin 27) and the print image is modified (e.g. by suppressing the corresponding print field or by substituting or appending different strings in the print field) as specified in the conditions. Then at 128 the print image is completed and the system exits to complete processing in a conventional manner which need not be described further here for an understanding of the subject invention.

[0066] If no exception flags are set the system goes directly to 128.

[0067] The embodiments described above and illustrated in the attached drawings have been given by way of example and illustration only. From the teachings of the present application those skilled in the art will readily recognize numerous other embodiments in accordance with the subject invention. Accordingly, limitations on the subject invention are to be found only in the claims set forth below.

What is claimed is:

1. A method for processing of a mailing by a mail preparation system, said method comprising the steps of:

a) providing means for assembling said mailpieces, said assembling means including a programmable controller programmed to control assembly of said mailpieces in accordance with information included in a mailpiece record, said assembly including causing at least one print field to be printed on an envelope for said mailpiece;

b) storing a predetermined Boolean combination of predetermined tests of at least one field of said mailpiece records;

c) said programmable controller controlling said means for assembling to assemble said mailpieces in accordance with said information and, for each of said mailpieces, prior to printing said print field, determining if said Boolean combination is satisfied; and

d) if said Boolean combination is not satisfied, diverting said mailpiece.

2. A method as described in claim 1 wherein a plurality of said fields of said mailpiece records are tested.

3. A method as described in claim 1 wherein printing of said print field is modified if said Boolean combination is not satisfied.

4. A method as described in claim 3 wherein said print field is suppressed.

5. A method as described in claim 3 wherein a predetermined string of alphanumeric characters is appended to said print field.

6. A method as described in claim 1 wherein said diverted mailpiece is processed as non-qualified mail.

7. A method as described in claim 1 wherein said print field includes a barcode representation of address information.

8. A method as described in claim 7 wherein said print field is suppressed.

9. A method for processing of a mailing by a mail preparation system, said method comprising the steps of:

a) providing means for assembling said mailpieces, said assembling means including a programmable controller programmed to control assembly of said mailpieces in accordance with information included in a mailpiece record, said assembly including causing at least one print field to be printed on an envelope for said mailpiece;

b) storing a predetermined Boolean combination of predetermined tests of a plurality of fields of said mailpiece records;

c) said programmable controller controlling said means for assembling to assemble said mailpieces in accordance with said information and, for each of said mailpieces, prior to printing said print field, determining if said Boolean combination is satisfied; and

d) if said Boolean combination is not satisfied modifying further processing of said mailpiece.

10. A method as described in claim 9 wherein said print field is modified.

11. A method as described in claim 10 wherein said print field is suppressed.

12. A method as described in claim 11 wherein a predetermined string of alphanumeric characters is appended to said print field.

13. A mail preparation system, comprising:

a) means for assembling said mailpieces, said assembling means including a programmable controller programmed to control assembly of said mailpieces in accordance with information included in a mailpiece record, said assembly including causing at least one print field to be printed on an envelope for said mailpiece;

b) a data store storing a predetermined Boolean combination of predetermined tests of at least one field of said mailpiece records;

c) a diverted for changing the path of said mailpieces;

d) said programmable controller being programmed to:

d1) control said means for assembling to assemble said mailpieces in accordance with said information;

d2) for each of said mailpieces, prior to printing said print field, determine if said Boolean combination is satisfied; and

d3) if said Boolean combination is not satisfied, divert said mailpiece.

14. A mail preparation system as described in claim 13 wherein said programmable controller is further programmed to modify said print field if said Boolean combination is not satisfied.

15. A mail preparation system as described in claim 14 wherein said print field is suppressed.

16. A mail preparation system as described in claim 14 wherein a predetermined string of alphanumeric characters is appended to said print field.

17. A mail preparation system as described in claim 13 wherein said Boolean combination is selected to identify non-qualified mail.

18. A mail preparation system, comprising:

a) means for assembling said mailpieces, said assembling means including a programmable controller programmed to control assembly of said mailpieces in accordance with information included in a mailpiece record, said assembly including causing at least one print field to be printed on an envelope for said mailpiece;

b) a data store storing a predetermined Boolean combination of predetermined tests of a plurality of fields of said mailpiece records;

c) said programmable controller being programmed to:

c1) control said means for assembling to assemble said mailpieces in accordance with said information;

c2) for each of said mailpieces, prior to printing said print field, determine if said Boolean combination is satisfied; and

c3) if said Boolean combination is not satisfied, modify further processing of said mailpiece.

19. A mail preparation system as described in claim 18 wherein said print field is modified.

20. A mail preparation system as described in claim 18 wherein said print field is suppressed.

* * * * *



US006581097B1

(12) **United States Patent**
Lynch et al.

(10) Patent No.: **US 6,581,097 B1**
(45) Date of Patent: **Jun. 17, 2003**

(54) **METHOD AND SYSTEM OF DETERMINING
A JOB TICKET FOR A PRINT STREAM
DETERMINING PROCESS**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/222,640**

(22) Filed: **Dec. 30, 1998**

(51) Int. Cl.⁷ **G06F 17/40; G06F 15/16**

(52) U.S. Cl. **709/226; 710/5; 358/1.15;
399/10; 399/77; 399/82**

(58) Field of Search **709/217, 218,
709/219, 223, 226, 236; 710/5, 6, 7; 358/1.1,
1.15; 705/1, 5, 6, 400, 406; 707/500, 505;
399/1, 8, 9, 10, 75, 76, 77, 82**

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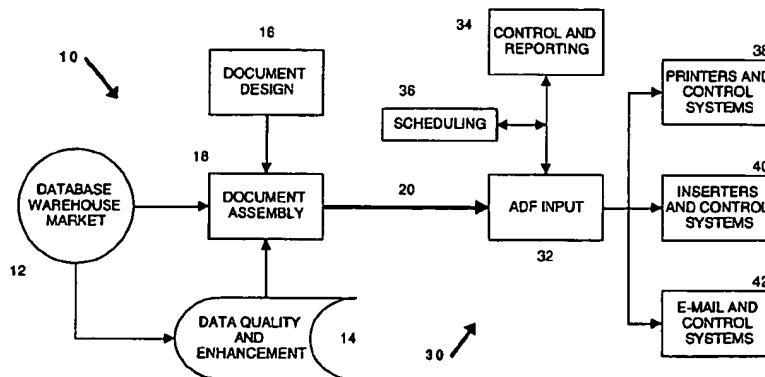
Primary Examiner—Dung C. Dinh

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(57) **ABSTRACT**

The invention is a method of establishing, and a structure for, a print stream job ticket. The method begins with receiving a unique job message identifier from a server client, where the identifier is representative of a particular print processing job. Once the identifier is received, the method locates a job ticket template database then attempts to match the received identifier with a template located in the database. The matching step is accomplished by plotting each element of the identifier to determine a set of elements to be mapped against a corresponding template. The identifier is then mapped against each one of the templates to determine a match based upon a set of matching rules. If a match exists, the matched template is selected to establish a new job ticket. If no match exists, then the next closest match between the identifier and any one of the templates is determined to establish a match; and, then the method creates a new job ticket template, and endows it with a set of print job parameters. The job ticket structure itself is representative of a print stream job to be performed by the client server. The structure comprises a unique ticket identifier representative of the job ticket. It further comprises a set of jobs, each job further comprising job properties that define one or more attributes of a particular job. The job ticket additionally comprises a set of links to activate one or more peripheral devices for producing the print stream job.

11 Claims, 5 Drawing Sheets



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FIG. 1A

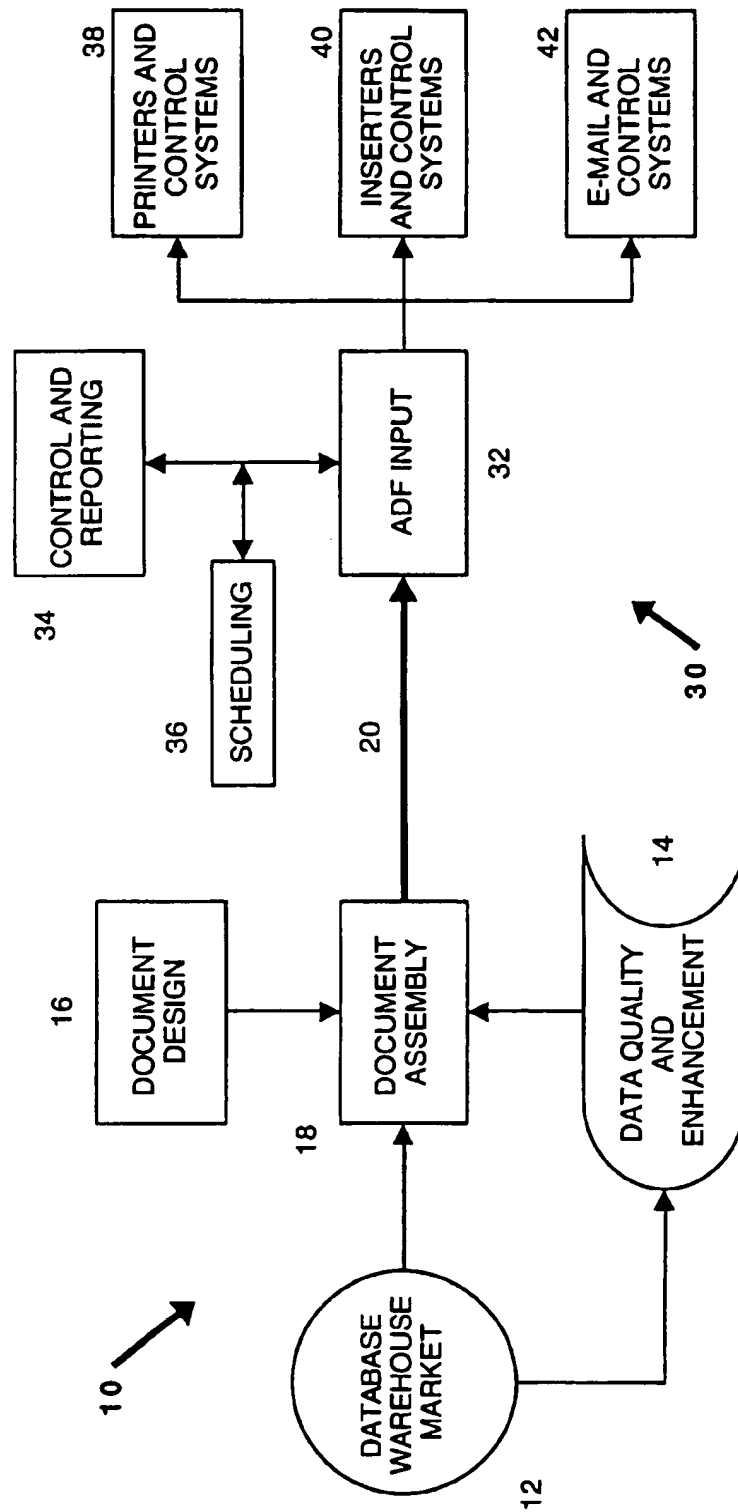
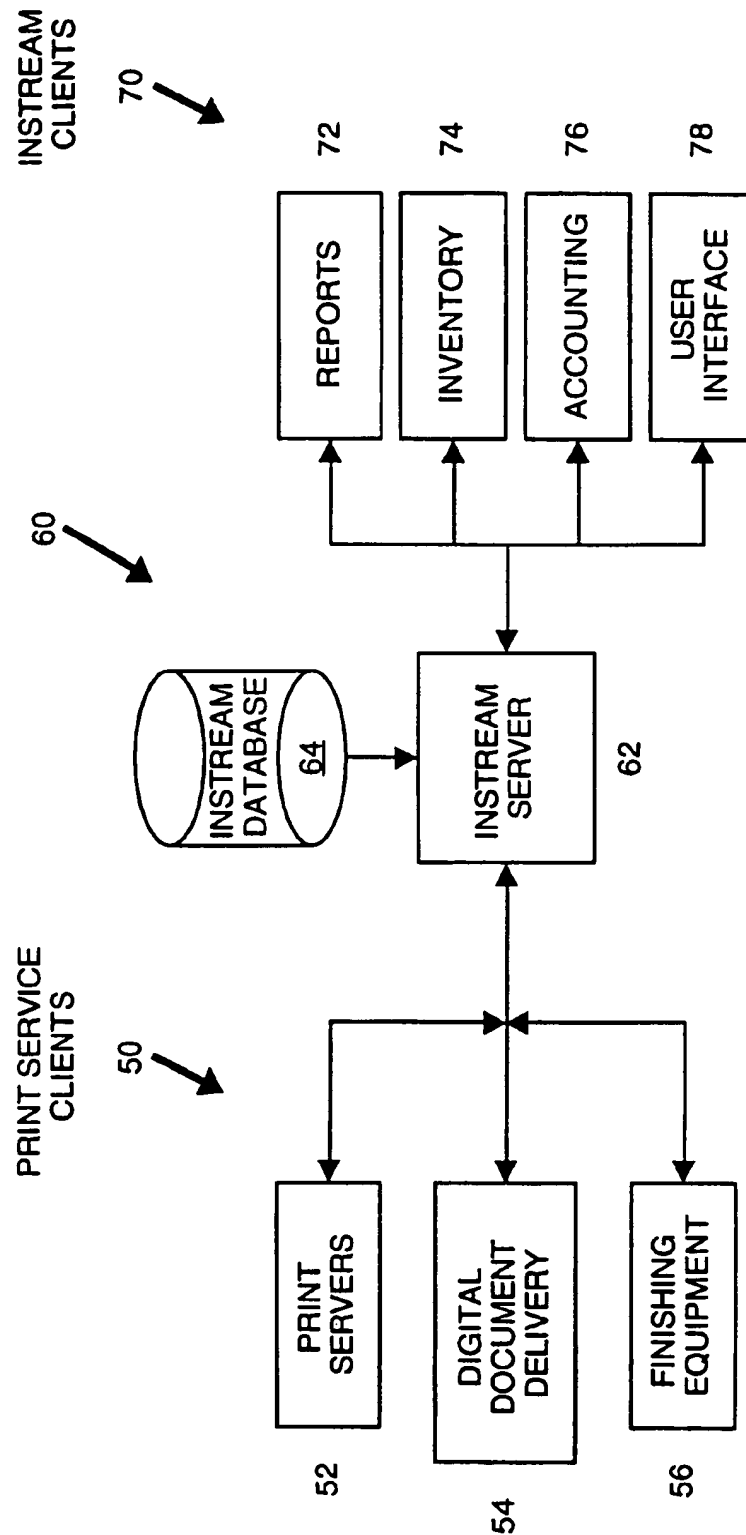
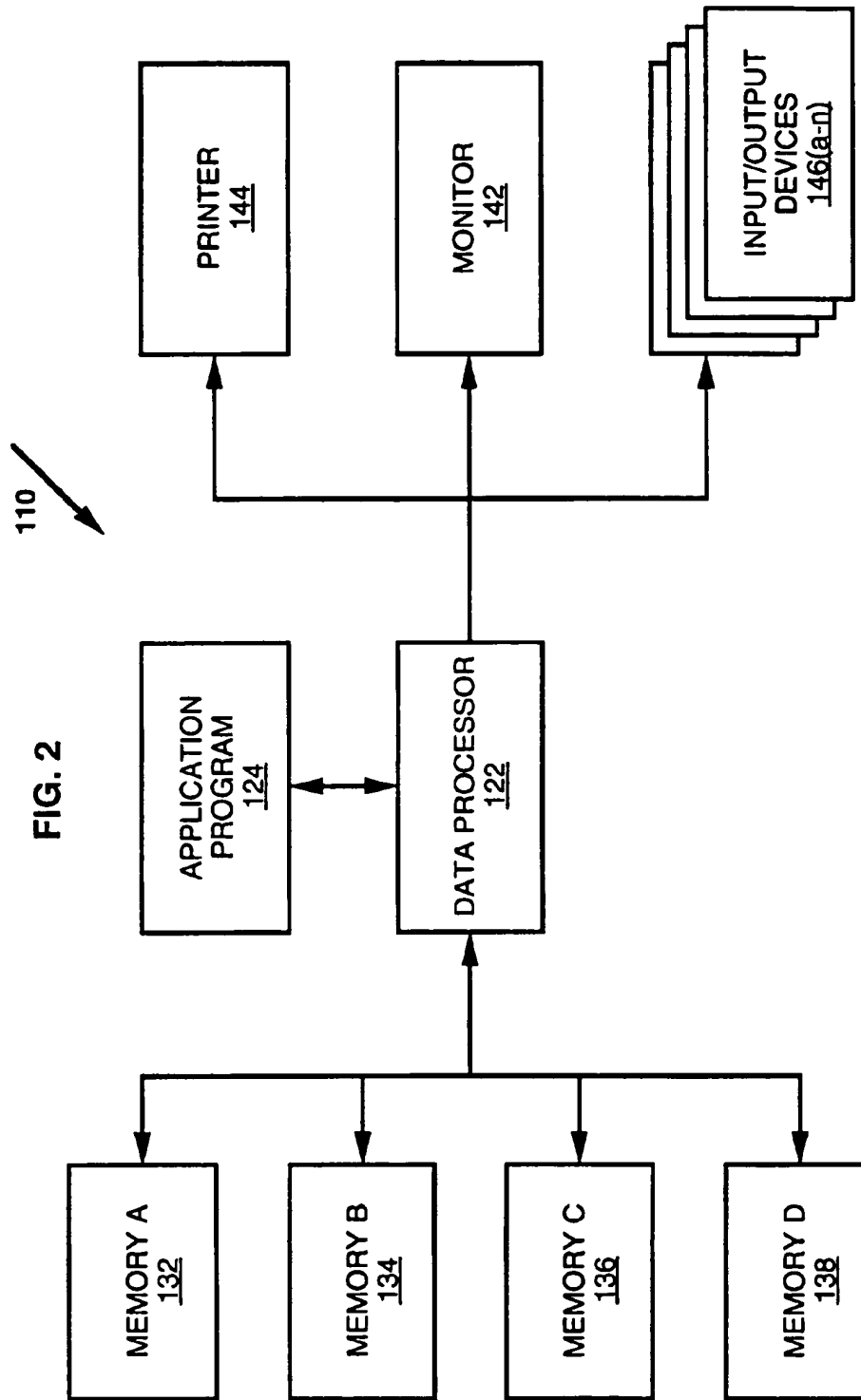
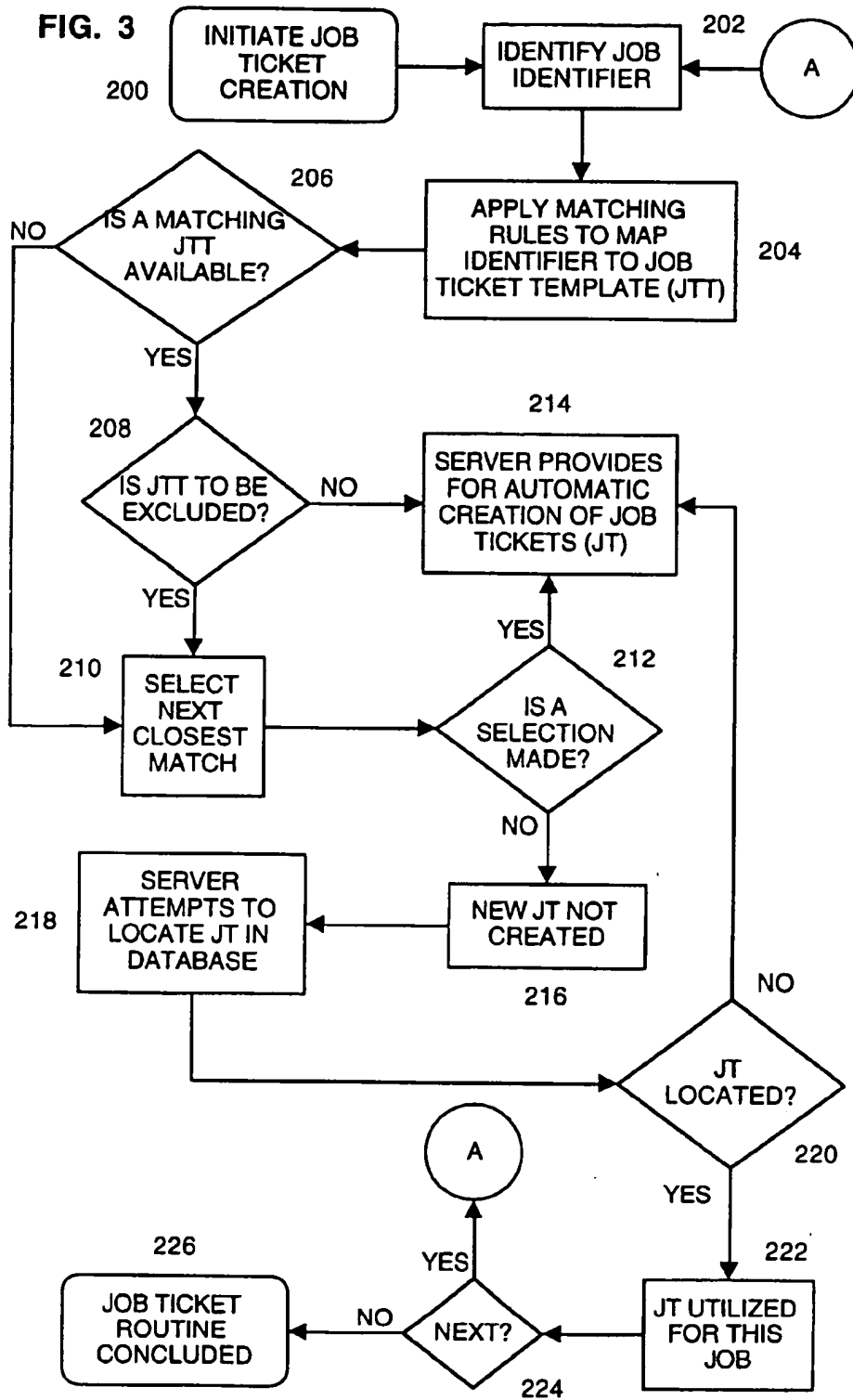
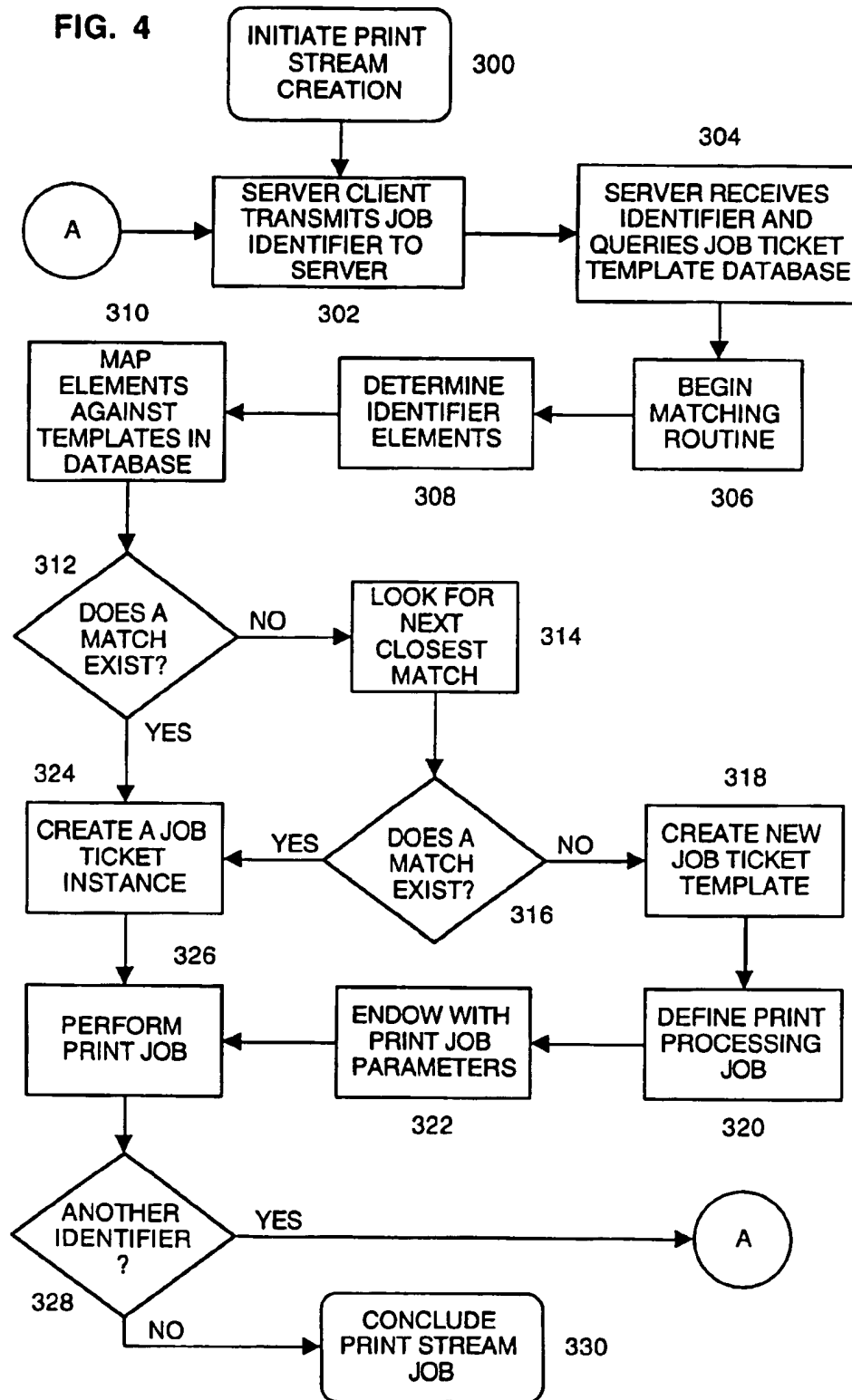


FIG. 1B









1

METHOD AND SYSTEM OF DETERMINING A JOB TICKET FOR A PRINT STREAM DETERMINING PROCESS

RELATED APPLICATIONS

Reference is made to application Ser. No. 09/222,745, entitled A METHOD AND SYSTEM FOR PRINT STREAM JOB DETERMINATION AND ANALYSIS, assigned to the assignee of this application and filed on even date herewith.

Reference is made to application Ser. No. 09/223,348, entitled MESSAGE STRUCTURE FOR A PRINT STREAM DETERMINING AND ANALYSIS SYSTEM, assigned to the assignee of this application and filed on even date herewith.

Reference is made to application Ser. No. 09/223,304, entitled A METHOD OF ESTABLISHING A SET OF PRINT STREAM OBJECTS IN AN OBJECT ORIENTED ENVIRONMENT, assigned to the assignee of this application and filed on even date herewith.

FIELD OF THE INVENTION

The general field of the invention is that of data processing, and, more specifically, print stream processing. In its most specific segmentation, the field is that of optimization of those devices directed to processing a print stream for the purpose of producing a plurality of mailpieces.

BACKGROUND OF THE INVENTION

In the past several years, significant changes have occurred in the operation of high volume document production centers. These centers have merged traditional printing capabilities with mailroom production facilities. Executives tasked with the management of both print and mail operations are expected to play an ever-growing role in the creation and design of document centers that will deliver effective, high quality, and high integrity output. The current development and emphasis on these centers in corporations or regional centers has lead to the growing use of the term "Automated Document Factory" (hereinafter "ADF") to describe consolidated printing and mail finishing operations.

In current practice, large mailing companies tend to separate the process of creating documents from the process of manufacturing documents (mailpieces). The print center tasked with finishing the created document receives both scheduled and scheduled print jobs with a wide range of requirements. These print jobs are evaluated, scheduled, and executed in the print/finish center.

Because the print/finish center has traditionally been "information systems poor," most of the work required to prepare or "condition" the print job for manufacturing was created in the business unit or print service client. Typical conditioning processes include: performing postal address hygiene; adding PostNet™ barcodes; presorting mailings; adding inserter barcode instructions; adjusting printer paper size and orientation; and, adding spot color instructions.

The manager of such a print/finish operation, seeking to maximize efficiency through optimal use of equipment and decision making tools, is faced with a dilemma. First, the decisions about the structure and management of the print/finish center are generally made outside of the center; the decisions are generally made by the Information Systems (IS) group creating the print job and its associated print stream. Document manufacturing requests are also assigned

2

lower priorities, further limiting management control. Second, the hardware systems and their associated peripheral devices are often sourced from different manufacturers so that the printers and inserters being fed by the print stream are relying on differing motivators from the print stream.

To help classify and organize the concept of the emerging print/finish center, an architecture has been developed within the print stream industry that is referred to as the ADF. The Automated Document Factory™ architecture proposed by the Gartner Group of Stamford, Conn., provides a model for a set of processes that prepares and positions enterprises to manage the creation and delivery of high-volume digitized documents by using factory production techniques that appropriately and optimally mechanize document production. The raw materials of production (i.e., the document data and preparation instructions), enter the ADF which transforms them into digital documents and prepares them for delivery.

The architecture for the ADF is comprised of four (4) modules; these include: input; transformation; delivery and preparation; and, control and reporting. Each module, or building block, is made up of other modules and each is connected by a series of interfaces, or links.

Each of the building blocks must be linked through effective communication which includes the tracking and measurement of the input and output of the document manufacturing hardware and associated peripherals. To enhance productivity and cost-effectiveness of the overall system, systems managers need to be able to scrutinize every element of the print job process to see where improvements can be made. Thus, each of the modules takes on an increased significance when viewed with respect to their relationship with the overall system.

There is thus a need to provide each of the modules for the ADF so that the structure can be self supporting and viable. The input module is where all of the data and instructions needed to transform the arriving print stream data into documents enters the ADF. The present invention is currently being introduced to the print stream market by the assignee of the present invention, Pitney Bowes Inc. of Stamford, Conn., as the InStream™ server which is designed as the input module for the ADF.

It is an object of the present invention to provide a significant sub-module that supports the input module of the conceptual ADF frame by describing herein the establishment and use of a job ticket. The job ticket drives the manufacturing process by providing the parameters for the job to be performed.

It is a further object of the present invention to provide a method of optimizing the use of time and hardware performance in manufacturing documents that have been digitally delivered through the input module.

SUMMARY OF THE INVENTION

The invention is a method of establishing a job ticket representative of a print stream job, and the structure of the job ticket, to be performed by a client server.

The method begins with the step of receiving a unique job message identifier from a server client, wherein the unique job message identifier is representative of a particular print processing job. The print processing job, in turn, further comprises: a printer selection routine; and/or, an inserter instruction set; and/or, a communication instruction set. Once the unique job message identifier is received, then the method locates a job ticket template database representative of a set of unique job message identifiers.

3

The method then attempts to match the received unique job message identifier with a job ticket template located in the job ticket template database. The matching step is accomplished by plotting each element of the unique message identifier to identify a set of elements to be mapped against a corresponding job ticket template. The database comprising a set of one or more job ticket templates is selected, and the unique message identifier is mapped against each one of the one or more job ticket templates. The initial job ticket template is created by a system operator to form a model for subsequent job tickets created during the ticket matching step and wherein the template is copied during the ticket matching step to create a new job ticket instance. It is then determined whether or not a first match exists between the unique message identifier and any one of the one or more job ticket templates. If a match exists, then the matched template is selected to establish a new job ticket. However, if no match exists, then the next closest match between the unique message identifier and the any one of the one or more job ticket templates is determined to establish a second match. The match determination is based upon a set of one or more matching rules. It is important to note that the rules may comprise an exclusion wherein the message identifier is identified as being excluded from being matched against the one or more templates.

If it is determined that a match exists between the received unique job message identifier and the job ticket template; then the method produces a job ticket instance. And, if the match is not found to exist, then creating a new job ticket template, and endowing the new job ticket template with a set of print job parameters representative of the print stream job.

If a match is not determined, however, then the method logs a system event. The system event initiates the creation of a new set of job parameters wherein the parameters establish a job ticket representative of the parameters, and wherein further, the job ticket establishes a job ticket template which is stored in the database of the client server.

The job ticket structure itself is representative of a print stream job to be performed by the client server. The structure comprises a unique ticket identifier representative of the job ticket. It further comprises a set of one or more jobs, each one of the one or more jobs further comprising job properties that define one or more attributes of a particular job. The attributes, in turn, comprise a name, a value, and a type.

The job ticket additionally comprises a first set of one or more links to a first set of one or more objects corresponding to each one of the first set of links and wherein the first set of objects activate a set of one or more peripheral devices for producing the print stream job. The first set of one or more objects may contain a printer selection routine, an inserter instruction set, and/or, a communication instruction set. The job ticket further provides a second set of one or more links to a second set of one or more objects corresponding to each one of the second set of links wherein the second set of objects activate a set of one or more routines for establishing statistics and/or reporting representative of the print stream job.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is an upper level block diagram of a host system which is capable of supporting the method of the present invention.

FIG. 1B is a block diagram of the system of the present invention and is shown as three (3) subsystems.

FIG. 2 is a block diagram of a data processing system which is representative of a system which could act as host to the invention's method.

4

FIG. 3 is an upper level flowchart of the method of assembling a job ticket which can be performed by the print stream processing application.

FIG. 4 is a detailed flowchart of the method of assembling a job ticket by matching a unique job message identifier with templates in a job ticket template database.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1A is an upper level block diagram of a host system which is capable of providing input to, and supporting, the method of the present invention while further providing output paths.

The system is divided into two subsystems; these are designated as document creation 10 and document manufacturer 30 which will also be referred to as the Automated Document Factory or ADF.

Document creation 10 includes a database warehouse market 12 which provides one or more data streams to be incorporated within the document assembly at document assembly station 18. The data streams are sourced from one or more databases contained within the database warehouse market 12 at the request of a document assembly routine within document assembly 18. The data may pass directly to document assembly 18 or may first pass through data quality and enhancement routine 14. Data quality and enhancement routine 14 processes data so as to prepare it for the requirements of the document assembly routine. If the document assembly routine does not require quality or enhancement processing, then the data would pass directly from the database warehouse market 12 to document assembly 18.

Document assembly 18 prepares a digital document and transmits the document to an ADF via a digital document transmission 20 known as a print stream. The ADF subsystem is shown in FIG. 1A as document manufacturer 30.

Document manufacturer 30 receives the digital document transmission 20 at the ADF input 32 and assigns a job ticket to the stream which is indicative of the print parameters associated with the print stream. ADF input 32 will re-direct the stream in accordance with the job ticket to various peripheral devices for printing and/or various output paths for re-transmission or data storage. The peripheral devices and output paths include: printers and their associated control systems 38; inserters and their associated control systems 40; and, E-mail and transmission control systems 42. It should be noted that the current invention is not limited to the embodiment shown, but may include any print stream finishing device such as console print stream finishers, storage devices for re-transmission, or interim data quality and enhancement routines for processing the print stream.

As ADF input 32 processes and directs the print stream, it will constantly monitor the forces acting on the print stream through control and reporting routines 34; these routines will in turn interface with scheduling module 36 to promote efficiency in current or subsequent print stream processing.

Turning to FIG. 1B there is shown a block diagram of the system of the present invention which is further broken down into three (3) subsystems designated as print service clients 50, InStream server system 60, and InStream clients 70.

Print service clients 50 is comprised of: print servers 52 which are receiving one or more print streams from InStream server 62 and reporting back statistical or process data which can be used by InStream clients 70 to manage the

document creation process; digital document delivery systems 54 which enable high-volume mail producers to utilize existing legacy-generated print streams, and the images they contain, to further access internet billing and bill present-
ment applications; and, finishing equipment 56 for actually
producing the document defined by the print stream.

Print service clients 50 communicate with InStream server system 60 via TCP/IP sockets. TCP/IP sockets are known to those skilled in the art and do not require further
detail or explanation to fully appreciate and understand the
present invention.

InStream server system 60 comprises InStream server 62 and InStream database 64. In one embodiment of the present invention, InStream server 62 is a multi-threaded, concurrent server running on the Win32™ platform (available from Microsoft Corporation of Redmond, Wash.). InStream server 62 is implemented in the Java™ programming language (available from Sun Microsystems, Inc. of Palo Alto, Calif.) and is therefore not necessarily restricted to the Win32 platform. Database access is provided via the Microsoft SQL™ server.

InStream clients 70 further comprises: reports 72 for producing print stream and finishing reports that can be used to monitor the system, determine optimal peripheral and system efficiencies or detail production; inventory 74 for monitoring system-wide capacity; accounting 76 for monitoring time and expense for sub-routines or document production activities; and, user interface 78 for monitoring of client activities.

Now turning to FIG. 2 there is shown a block diagram of a data processing system which is representative of a system which could act as host to the invention's method.

The ADF server is represented by data processing system 110 which is based on data processor 122. Data processor 122 is a central processing unit (CPU) of a computer (such as a personal computer (PC), a mid-frame (IBM AS/400), or main frame) and its associated RAM or other memory, operating system software, and application systems which are capable of performing basic print stream processing functions (such as SmartMailer® which is available from Pitney Bowes Inc. of Stamford, Conn.) or more advanced print stream processing (such as StreamWeaver® which is available from Pitney Bowes Inc. of Stamford, Conn.). The base components of the data processor 122 are known in the art and do not require a detailed description herein for an understanding of their utility and application.

Interoperatively connected to data processor 122 is the application program 124 which is the basis for the present application. Additionally, connected to data processor 122 are memory cells 132, 134, 136, and 138 which are utilized for saving various data streams being processed by the application program 124. The multiple memory means of the system may be located independently of each other, or may exist in co-located combinations. Varied memory means are contemplated wherein the memory may exist in the form of a PROM chip, PROM card, magnetic media, or other commercially available forms. The system layout, with respect to the memory, is at the convenience of the system designer. Further coupled to data processor 122, is printer 144 for document or print stream data output, monitor 142 which allows a system operator to view transactions occurring within the application program 24, and various input/output devices 146(a-n). Input and output devices 146(a-n), such as a keyboard for data input, or a modem for data transmission or reception can be interoperatively connected or interfaced to data processor 122 as appropriate.

Turning to FIG. 3, there is shown an upper level flowchart of the method of assembling a job ticket which can be performed by the print stream processing application. The InStream job ticket is a collection of parameters, attributes and processes required for the successful production of a document such as a mailpiece. Job tickets, initially are created manually by the systems operator and are specific to individual jobs or job groups. A job group is a collection of jobs with matching attributes. For example, a group of marketing jobs that all print on the same type of printer require the same type of form and must be finished on the same type of inserter can be grouped together to form a job group. A more detailed description of the job ticket and its creation is detailed in the co-pending application referenced hereinabove.

Job ticket creation is initiated at step 200 before advancing to step 202 where the job identifier is identified from the print stream data. Each message accompanying the print stream that an InStream client sends to the server contains a unique job identifier. Upon identifying the job identifier, the method advances to step 204 where the server applies matching rules to map the identifier to a job ticket template (JTT). Matching rules are established in the InStream database. Once the matching rules are applied, the method advances to a query at step 206.

Step 206 queries as to whether or not a matching JTT is available for the job identifier. If the response to the query is "NO," then the method advances to step 210 where the next closest match is determined as based upon the matching rules; otherwise, if the response is "YES," then the method advances to a query at step 208. The query at step 208 queries as to whether or not the JTT is to be excluded. The method allows for the exclusion of jobs from InStream server processing; thus, if the matching rules for a message identifier or range of identifiers indicate exclusion, then any associated JTTs are not run.

If the response to the query at step 208 is "YES," then the method advances to step 210 where the next closest match is determined as based upon the matching rules. From step 210, the method advances to a query at step 212 which asks if a template selection has been made. If the response is "YES," then the method advances to step 214 where the InStream server provides for the automatic creation of a new job ticket (JT). If the response to the query at step 208 is "NO," however, then the method advances directly to step 214.

Returning to the query at step 212, if the response to the query is "NO," then at step 216 a decision is made that a new job ticket will not be created. From step 216, the method advances to step 218 where the InStream server attempts to locate an existing, matching job ticket in the database. The method then advances to step 220 where the method queries as to whether or not a job ticket was located in the database. If the response is "NO," then the method returns to step 214. However, if the response to the query at step 220 is "YES," then the InStream server will utilize, at step 222, the located, existing JT to run the current job.

When the JT has been utilized in step 222, the method will advance to step 224 and query as to whether or not there is a next job identifier to be identified. If the response to the query is "YES," then the method returns via path A to re-enter the method flow at step 202. If the response to the query at step 224 is "NO," however, then the method advances to step 226 and concludes the job ticket routine.

Turning to FIG. 4, there is shown a detailed flowchart of the method of assembling a job ticket by matching a unique job message identifier with templates in a job ticket template database.

There are a number of concepts which must be described before embarking on the discussion of FIG. 4. First, matching rules are established in the InStream database by which a message's unique identifier is mapped to exactly one job ticket template (JTT). A JTT is a template that the operator creates to form the basis for future job tickets. The template acts as a container for job templates. The job template contains default job properties which the operator defines. Additionally, the job template is copied when ticket matching occurs to create a new job instance. Job ticket template matching is the process by which job message identifiers are mapped with job ticket templates. A job ticket is an instance (a copy) of a job ticket template. After job ticket template matching occurs, a job ticket template is copied to create a new job ticket. The job ticket contains a collection of jobs. A job is an instance (a copy) of a job template. After job ticket template matching occurs, a job template is copied to create a new job. The job contains a collection of job properties that define attributes of the job. This collection is copied from the job template and is augmented by job message properties. A job message is sent from an InStream client to the InStream server; it may contain one or more job properties. A job property is an attribute of a particular job and contains a name, a value, and a job type.

The method flow begins with step 300 where the print stream creation is initiated. Each message that an InStream client sends to the server contains a unique job identifier. The method advances from step 300 to step 302 where the InStream server's client transmits the print job and its associated job message identifier to the server. The server receives, at step 304, the identifier and queries a selected job ticket template database so that a matching routine can be initiated at step 306. Upon reception of the message, the server attempts to locate a Job Ticket Template (JTT) which matches the unique job message identifier. The method then advances from step 306 to step 308 where the elements comprising the job message identifier are determined.

The determination of the job message identifier elements is important because it allows the InStream server to map, at step 310, the elements against the templates (JTTs) stored in the job ticket template database to determine a match. Each JTT has its own unique identifier as well. Additionally, the wildcard character "*" is utilized to allow a range of job identifiers to map to a JTT. The server attempts an exact match first; if no match occurs, the server looks recursively for the next closest match. If no match is found, a system event is logged. If the match is not exact (i.e., it matches to an "*"), a system event is logged to inform the system operator for future reference or reporting purposes.

The system allows for the exclusion of jobs from InStream processing. If the matching rules for a message identifier, or range of identifiers, indicate exclusion from the matching routine, then any associated JTTs are not run. If no matches are found for a message identifier, the default case of "*" is used; however, if the case were marked as "excluded," then a system event would be logged.

The following table shows some examples of how matching is employed by the server. The asterisk "*" is used as a wildcard character.

TABLE 1

Unique Message Identifier	JTT Identifier
*	100
AR*	120
AR1024	130
AR1025	140

TABLE 1-continued

Unique Message Identifier	JTT Identifier
AR1026	150
ABC*	160

EXAMPLES

(1) A message is received containing a unique job identifier consisting of "AR1025". An exact match is found. The server utilizes the JTT identified as "140" for all messages for that job identifier.

(2) A message is received containing a unique job identifier consisting of "AR3000". No exact match is found; therefore, continues searching and finds the next closest match to be "AR*". The server utilizes the JTT identified as "120" for all messages for that job identifier and logs an event to inform the user of an inexact match.

(3) A message is received containing a unique job identifier consisting of "B11000". No match is found; therefore, the server reverts to the default case of "*". If no exclusion has been specified for the default case, then the server utilizes the JTT identified as "100" for all messages for that job identifier and logs an event to inform the user of the occurrence of an inexact match.

The method advances from step 310 to the query at step 312 where the method queries as to whether or not a match exists between the message identifier and any one of the templates in the database. If the response to the query at step 312 is "YES," then the method advances to step 324 where a job ticket instance is created by copying the matched template to form a new job ticket. The method advances from step 324 to step 326. However, if the response to the query at step 312 is "NO," then the method advances to step 314 where the next closest match is selected before advancing to the query at step 316.

At step 316, the method queries as to whether or not a match exists between the message identifier and any one of the templates in the database as determined by element weighting. If the response to the query at step 316 is "YES," then the method advances to step 324 where a job ticket instance is created by copying the matched template to form a new job ticket. The method advances from step 324 to step 326. However, if the response to the query at step 316 is "NO," then the method advances to step 318 where a new job ticket template is created.

The creation of a new job ticket template at step 318 causes the template to be generated, at step 320, in accordance with the defined print process job. The parameters of the job are evaluated at step 322 before becoming part of the new job ticket. The job parameters embedded in the job ticket assigned to the particular job at hand are then performed at step 326.

After performance of the print job, the method queries as to whether or not another identifier is to be delivered with the incoming print stream. If the response to the query is "YES," then the method returns via path A to re-enter the method flow at step 302; otherwise, the method advances to step 330 where the print stream job and its associated routines are concluded.

While certain embodiments have been described above in terms of the system within which the InStream server may reside, the invention is not limited to such a context. The systems shown in FIGS. 1A, 1B and 2 are an example of a host system for the invention, and the system elements are intended merely to exemplify the type of peripherals and software components that can be used with the invention.

9

In the foregoing specification, the invention has been described with 20 reference to specific embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention. For instance, the sequence of steps shown in FIG. 3 can be altered while still producing an effective and valid method sequence. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense.

What is claimed is:

1. A method of establishing a job ticket representative of a print stream job to be performed by a client server, the method comprising the steps of:

- (a) receiving a unique job message identifier from a server client;
- (b) locating a job ticket template database representative of a set of unique job message identifiers;
- (c) matching said received unique job message identifier with a job ticket template located in said job ticket template database, wherein said matching step further comprises:
 - (i) plotting each element of said unique message identifier to identify a set of elements to be mapped against a corresponding job ticket template;
 - (ii) selecting a database comprising a set of one or more job ticket templates;
 - (iii) mapping said unique message identifier against each one of said one or more job ticket templates;
 - (iv) determining whether or not a first match exists between said unique message identifier and any one of said one or more job ticket templates; and, if a first match exists then selecting said determined matched template to establish a new job ticket; and, if no first match exists, then determining the next closest match between said unique message identifier and said any one of said one or more job ticket templates to establish a second match; and

10

(d) determining whether or not a match exists between said received unique job message identifier and said job ticket template; and, if said match exists then creating a job ticket instance; and, if said match does not exist then creating a new job ticket template; and endowing said new job ticket template with a set of print job parameters representative of said print stream job.

2. The method of claim 1, wherein said unique job message identifier is representative of a particular print processing job.

3. The method of claim 1, wherein said particular print processing job comprises a printer selection routine.

4. The method of claim 1, wherein said particular print processing job comprises an inserter instruction set.

5. The method of claim 1, wherein said particular print processing job comprises a communication instruction set.

6. The method of claim 1, wherein said job ticket template is created by a system operator to form a model for subsequent job tickets created during said ticket matching step and wherein said template is copied during said ticket matching step to create a new job ticket instance.

7. The method of claim 1, wherein said match determination is based upon a set of one or more matching rules.

8. The method of claim 7, wherein said set of one or more matching rules comprises an exclusion wherein said message identifier is identified as being excluded from being matched against said one or more templates.

9. The method of claim 1, wherein said system event initiates the creation of a new set of job parameters.

10. The method of claim 9, wherein said created set of job parameters establishes a job ticket representative of said parameters.

11. The method of claim 10, wherein said job ticket establishes a job ticket template which is stored in said database of said client server.

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US006370521B1

(12) **United States Patent**
Pigos, Jr. et al.

(10) Patent No.: **US 6,370,521 B1**
(45) Date of Patent: **Apr. 9, 2002**

(54) **TRACKING SYSTEM, METHOD AND
COMPUTER PROGRAM PRODUCT FOR
DOCUMENT PROCESSING**

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(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/181,497**

(22) Filed: **Oct. 28, 1998**

Related U.S. Application Data

(60) Provisional application No. 60/097,969, filed on Aug. 26,
1998, and provisional application No. 60/097,860, filed on
Aug. 25, 1998.

(51) Int. Cl.⁷ **G06F 17/30**

(52) U.S. Cl. **707/2; 707/10; 709/101;
709/203**

(58) Field of Search **707/3, 5, 1, 2,
707/10, 500; 705/410; 709/101, 201, 203,
217**

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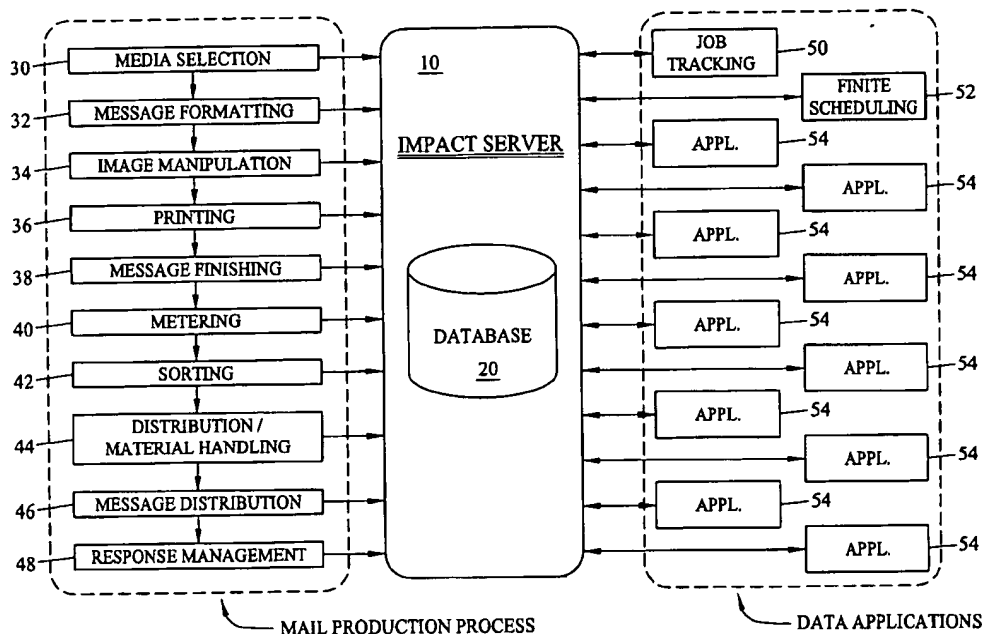
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(57) **ABSTRACT**

An integrated computer system architecture for tracking of
job data in a document processing environment including an
infrastructure built on processes, hardware, software and
interfaces designed to monitor and control mail processing
and data collection through a variety of manual and machine
processes in real-time. Computers, networks, web-based
applications, databases and scanners are used to interface
and integrate traditional mail processing equipment with
customized software. The invention integrates the entire
mail production process to form and establish a complete
end-to-end system. A job tracking scheme is detailed illus-
trating a particular data mining application.

51 Claims, 13 Drawing Sheets



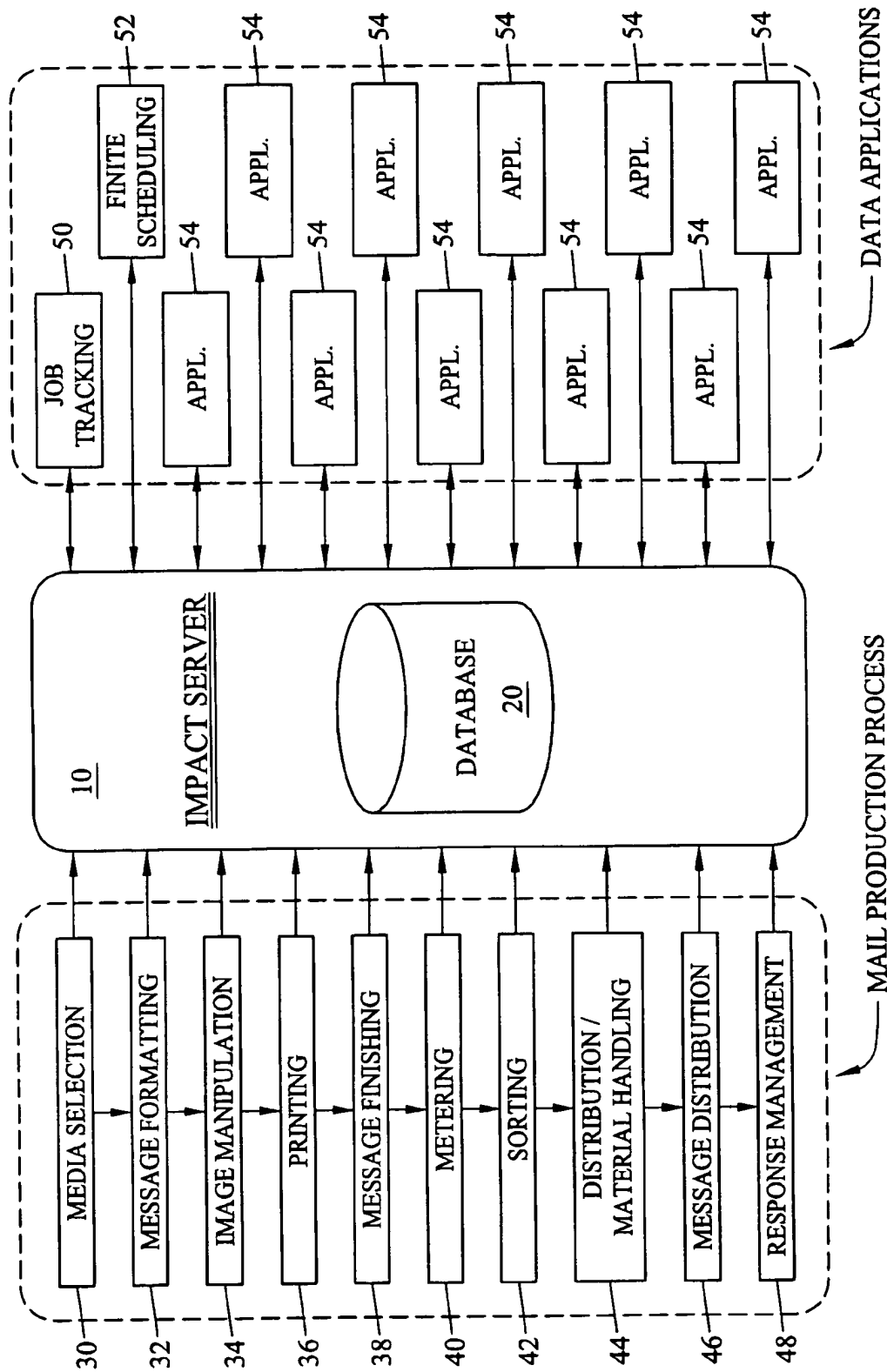
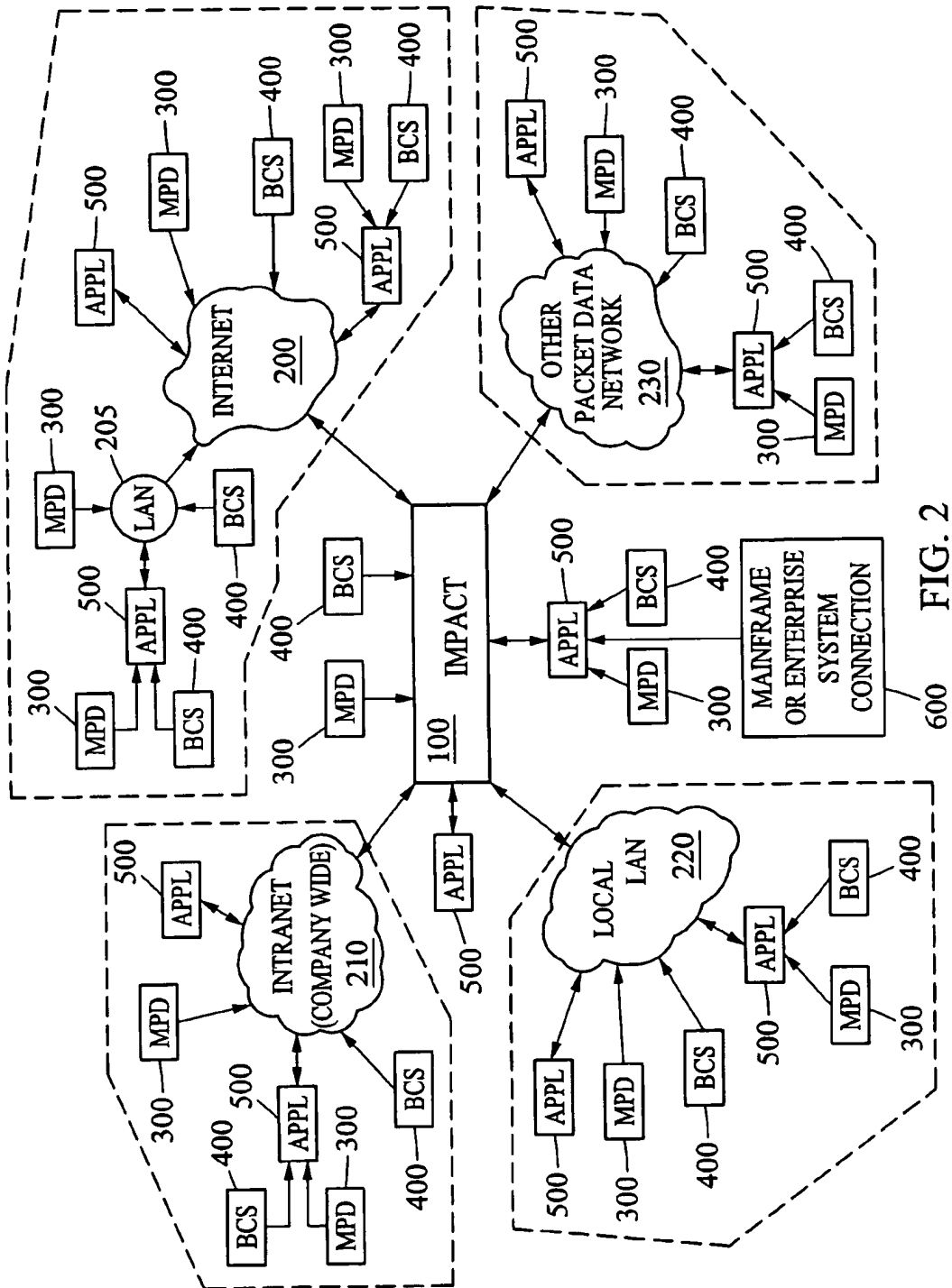


FIG. 1



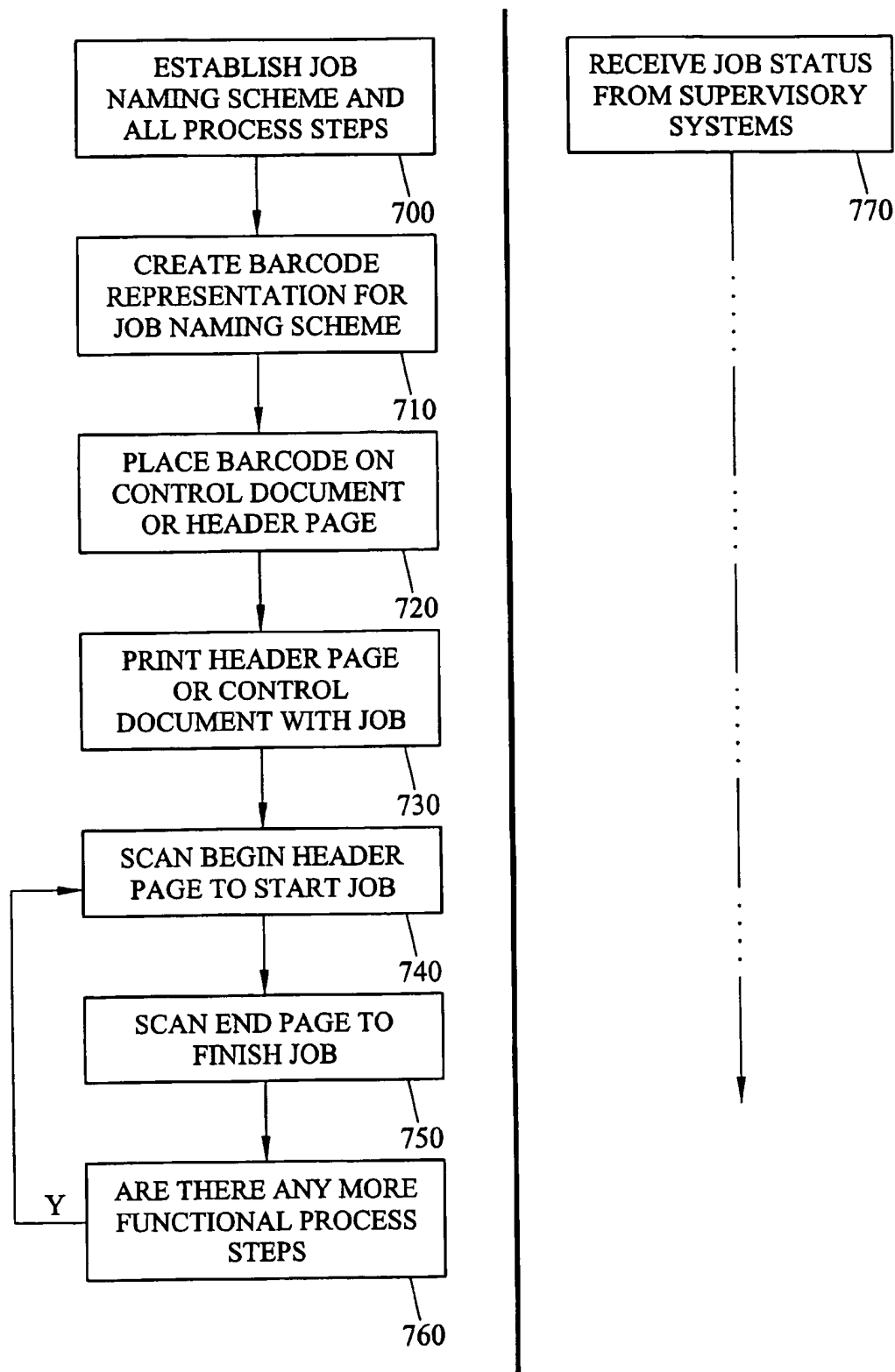


FIG. 3

USER NAME AND PASSWORD REQUIRED

ENTER USER NAME FOR UNKNOWN PROMPT AT
IMPACT.WTWITC.COM

USER NAME

PASSWORD

OK CANCEL

800

802

FIG. 4

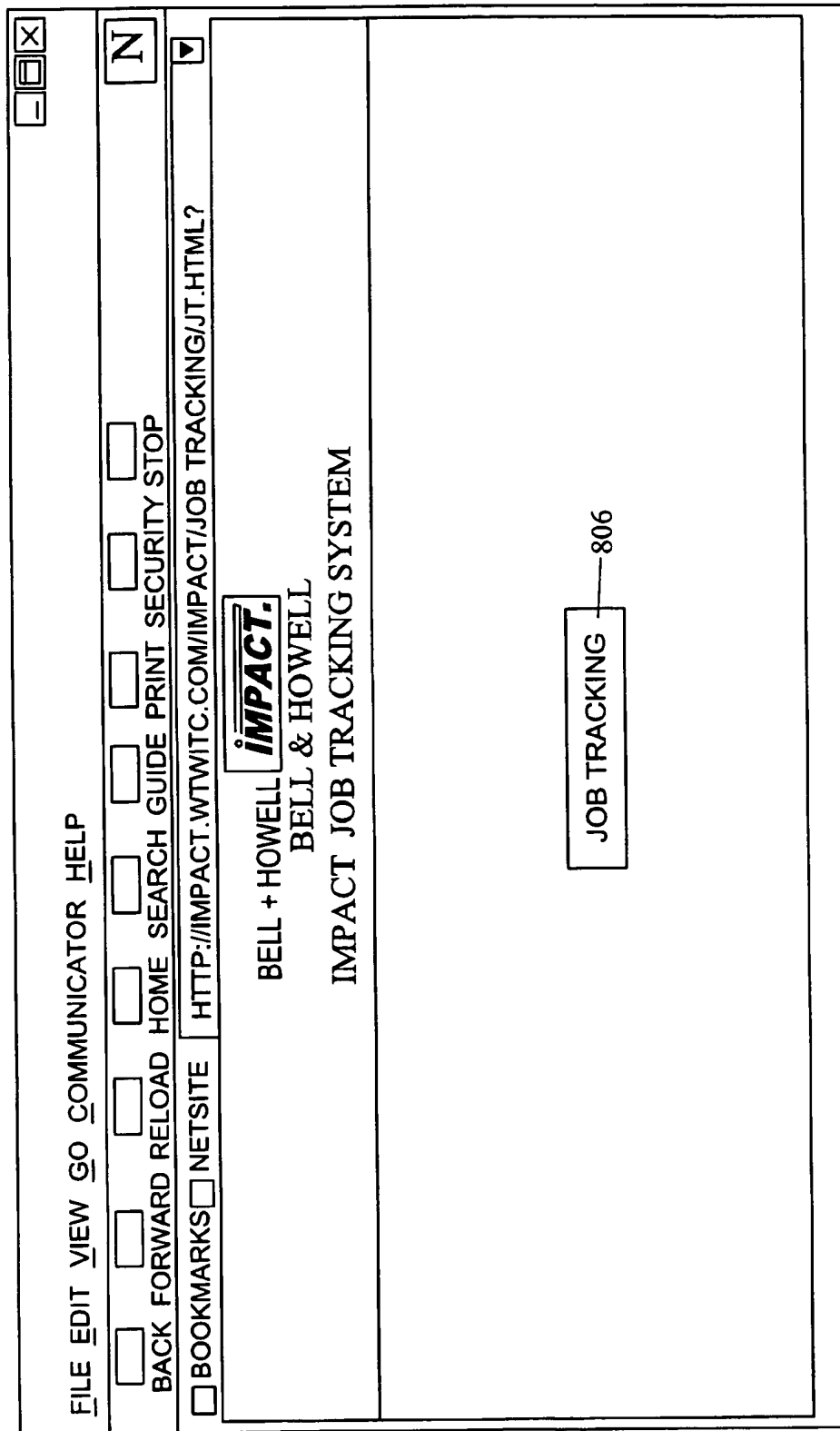


FIG. 5

FILE EDIT VIEW GO COMMUNICATOR HELP

BACK FORWARD RELOAD HOME SEARCH GUIDE PRINT SECURITY STOP

BOOKMARKS ☐ NETSITE ☐ HTTP://IMPACT.WTWITC.COM/IMPACT/JOB_TRACKING/JT_APPLET.HTML? ☐

N

808 810 812 814 816

BELL + HOWELL **IMPACT.** JOB TRACKING SYSTEM

TIME

BATCH

OPERATOR

MACHINE

STAGE

SELECT AND QUERY

TIME CRITERIA

LAST DAY

RUN QUERY 818

GROUP

STATEMENT I.D.

STATEMENT TYPE

BATCH NUMBER

NUMBER OF ENVELOPES

NUMBER OF PAGES

822

820

NUMBER OF BATCHES

NUMBER OF ENVELOPES

NUMBER OF PAGES

0

824

0

CLEAR RESULTS 826

SHOW TRANSACTIONS! 827

FIG. 6

11/17/2003, EAST Version: 1.4.1

FILE EDIT VIEW GO COMMUNICATOR HELP									
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N
BACK FORWARD RELOAD HOME SEARCH GUIDE PRINT SECURITY STOP									
<input type="checkbox"/> BOOKMARKS		<input type="checkbox"/> NETSITE		HTTP://IMPACT.WTWITC.COM/IMPACT/JOB_TRACKING/JT_APPLET.HTML? <input checked="" type="checkbox"/>					

BELL + HOWELL				<i>IMPACT.</i>				
808	810	812	814	816	JOB TRACKING SYSTEM			

SELECT AND QUERY			
TIME	BATCH	OPERATOR	MACHINE STAGE

TIME CRITERIA			
<div style="display: flex; justify-content: space-between;"> ALL 828 </div> <div style="margin-top: 10px;"> LAST DAY PAST 2 DAYS PAST 3 DAYS PAST 4 DAYS PAST 5 DAYS </div>			

RUN QUERY		818		BATCHES		CLEAR RESULTS		826	
-----------	--	-----	--	---------	--	---------------	--	-----	--

GROUP	STATEMENT I.D.	STATEMENT TYPE	BATCH NUMBER	NUMBER OF ENVELOPES	NUMBER OF PAGES
	822			820	

SUMMARY		827	
NUMBER OF BATCHES	0	NUMBER OF ENVELOPES	0
NUMBER OF PAGES	0		

SHOW TRANSACTIONS!		827	
--------------------	--	-----	--

FIG. 7

808 810 812 830 814 816 832 834 836

TIME BATCH OPERATOR MACHINE STAGE

GROUP

STATEMENT I.D.

STATEMENT TYPE

BATCH NUMBER

ALL

ALL

CWRR

INDV

INST

TAX

FIG. 8

808	810	812	814	816
TIME	BATCH	OPERATOR	MACHINE	STAGE
OPERATOR NAME				
<div> <div>ALL</div> <div> <div>ALL</div> <div> <div>CRIMMINS, STEVE</div> <div>MELNICK, STEPHEN</div> <div>POWELL, TRAVIS</div> <div>RUIZ, MARCO</div> <div>WANG, TONY</div> </div> </div> </div>				

838

FIG. 9

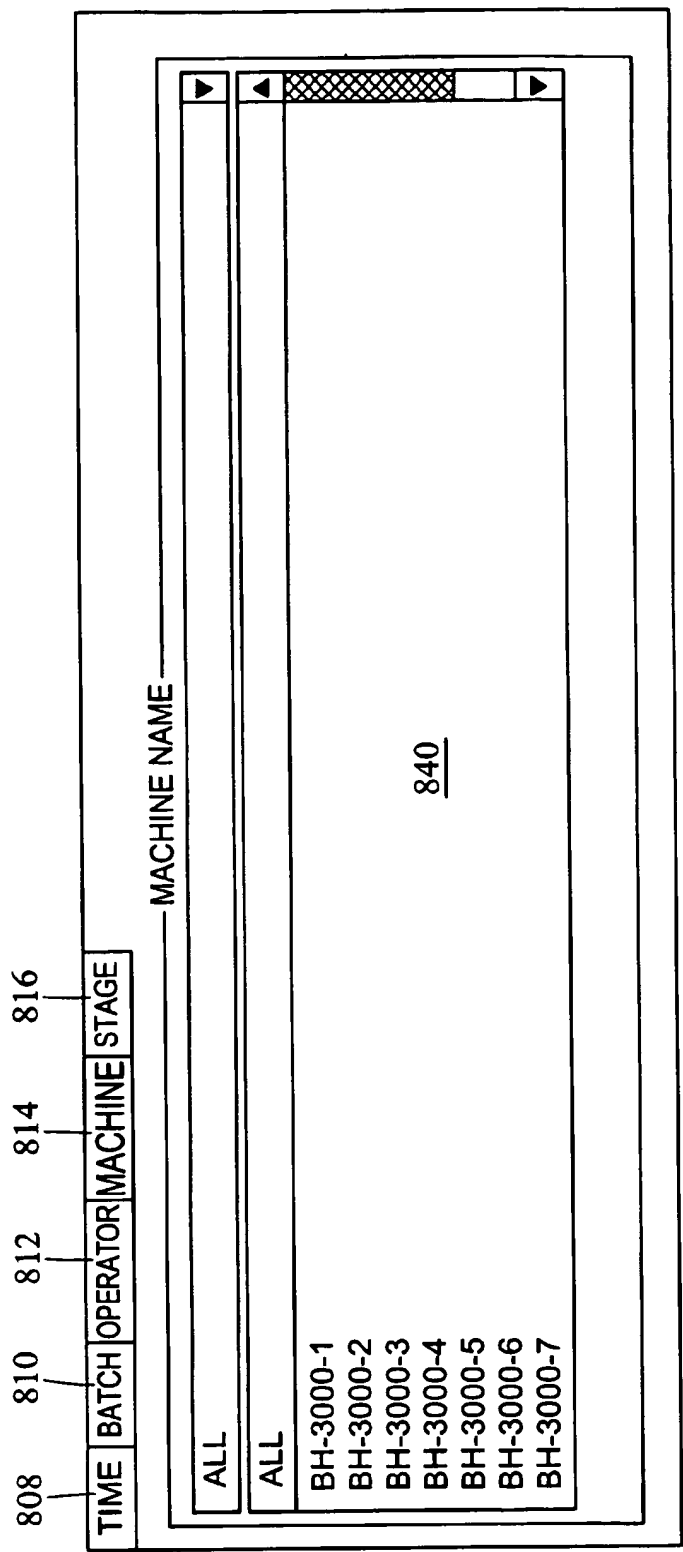


FIG. 10

808	810	812	842	814	816	844
TIME	BATCH	OPERATOR	MACHINE	STAGE		
PRODUCTION ROUTE			STAGE			
<input checked="" type="radio"/> AUTOMATIC <input type="radio"/> MANUAL <input type="radio"/> EKTA JET			<input checked="" type="radio"/> ANY STAGE <input type="radio"/> PRINTING <input type="radio"/> WAITING FOR INSERTING <input type="radio"/> INSERTING <input type="radio"/> COMPLETED INSERTING			

FIG. 11

BATCHES						
GROUP	STATEMENT I.D.	STATEMENT TYPE	BATCH NUMBER	NUMBER OF ENVELOPES	NUMBER OF PAGES	
CWRR	406BVBS	M2	002	22	44	
CWRR	DLY0302	M2	005	22	44	
INDV	102AFLA	M1	001	22	44	
INDV	102AFLA	M1	002	0	2134	
INDV	102AFLA	M1	003	22	44	
INDV	102AFLA	M1	007	22	44	
INDV	102AFLA	M1	44	216	432	
SUMMARY				35	898	
NUMBER OF BATCHES				824	819	
NUMBER OF ENVELOPES						
NUMBER OF PAGES						

FIG. 12

FILE EDIT VIEW GO COMMUNICATOR HELP

BACK FORWARD RELOAD HOME SEARCH GUIDE PRINT SECURITY STOP

☐ BOOKMARKS ☐ NETSITE [HTTP://IMPACT.WTWITC.COM/IMPACT/JOB_TRACKING/JT_APPLET.HTML?](http://IMPACT.WTWITC.COM/IMPACT/JOB_TRACKING/JT_APPLET.HTML?)

BELL + HOWELL **IMPACT.**
JOB TRACKING SYSTEM

TRANSACTIONS

BATCH I.D.: **INDV102AFLAM144**

GROUP: **INDV** BATCH NUMBER: **44**

STATEMENT I.D.: **102AFLA** TOTAL ENVELOPES: **216**

STATEMENT TYPE: **M1** TOTAL PAGES: **432**

TIME STAMP	TRANSACTION TYPE	MANAGING DEVICE	DEVICE	OPERATOR
1998-07-29 15:12:00.0	START INSERT	INT-2425-3	BH-3000-1	TYW
1998-07-29 15:12:10.0	FINISH INSERT	INT-2425-3	BH-3000-1	TYW
1998-07-30 08:04:00.0	START INSERT	INT-2425-3	BH-6000-1	SMM
1998-07-30 08:04:14.0	FINISH INSERT	INT-2425-3	BH-6000-1	SMM
1998-07-30 09:05:49.0	START INSERT	INT-2425-3	BH-6000-2	TOP
1998-07-30 09:12:53.0	FINISH INSERT	INT-2425-3	BH-6000-2	TOP
1998-07-30 09:15:25.0	FINISH INSERT	INT-2425-3	BH-6000-2	TOP
1998-07-30 09:17:56.0	FINISH INSERT	INT-2425-3	BH-6000-2	TOP
1998-07-30 11:04:49.0	START INSERT	INT-2425-3	BH-6000-3	SMM
1998-07-30 11:05:55.0	FINISH INSERT	INT-2425-3	BH-6000-3	SMM
1998-08-12 11:57:14.0	START INSERT	INT-2425-3	BH-6000-1	SMC

RETURN TO BATCH QUERY — 850

FIG. 13

1

TRACKING SYSTEM, METHOD AND COMPUTER PROGRAM PRODUCT FOR DOCUMENT PROCESSING

This Appln claims benefit of Prov. No. 60/097,860 filed Aug. 25, 1998 and No. 60/097,969 filed Aug. 26, 1998.

FIELD OF THE INVENTION

The present invention relates generally to tracking systems for tracking job data generated in document processing. More specifically, the present invention relates to a tracking system for tracking job data in automated mail document processing.

BACKGROUND OF THE INVENTION

The automation of document processing, particularly mail processing, is ever-evolving. As mail processing migrates to an Automated Messaging Factory (AMF) model, the need to "track" jobs and production in real-time becomes critical. Implementing job tracking in a mail processing environment is a complex integration of many different systems and functions. The current mail processing environment is one of constant change. New technologies, market changes, customer preferences, manufacturing tools and techniques are driving these changes. By way of background, the current mail processing environment typically can be viewed from three perspectives, the physical view, the process view, and the information (data) view.

The physical view of the mail processing environment comprises, inter alia, printing, inserting, metering, and sorting equipment or devices. In most cases, this equipment is standalone and is not connected to production control or supervisory systems. In many current mail processing operations, it is not uncommon to find mail processing devices that are ten to fifteen years old. Unfortunately older devices generally are not equipped with robust control systems or communication capabilities. Integrating these older mail processing devices is, therefore, somewhat of a challenge. Another characteristic found in the existing mail processing environment is that production information is typically recorded and tracked manually via operator and device log sheets. This is due to the standalone nature of the aforementioned production equipment.

The process view of the mail processing environment covers all of the major components that comprise the physical view (e.g., printing, inserting, metering, sorting, etc.). A key aspect of the process view is that it operates as an "open-loop" system. By open-loop, it is meant that verification and reconciliation of data among process steps (or functional areas) is not done. Verification and reconciliation features are important in the mail processing environment because they provide fundamental feedback regarding production, status, and results of mail processing jobs. A mail processing system having verification and reconciliation of data is considered a closed-loop control system. Jobs currently progress to and from each separate functional area manually only after the job is deemed complete. A job is deemed complete upon observations of supervisory personnel. In addition, separate processes (or functional areas) typically are not linked together according to job names or work flow techniques. Jobs are labeled with identifiers that map one functional name to another as the job proceeds through the mail processing environment. For example, jobs originating in the print area that are earmarked for the inserting area get renamed from print area "System ID" job names to inserting area job names that are related to com-

2

pany products such as "Checking" or "Market Rate Account" for instance.

The information view is probably the most important perspective in terms of job tracking. This is because job tracking is based on collecting and using production data to better manage and verify production. The information, or data, used currently in mail production processes possess three fundamental traits:

Data is manually collected thereby involving accuracy and timeliness issues;

Data is machine specific so operators are required to record data for their machine; and

Roll-up production reports must be developed manually through spreadsheets.

The current mail processing environment provides very limited forward planning capabilities because it is reaction driven meaning there are limited opportunities to define measurements and define improvements.

In general, what is needed is a pro-active mail processing environment focusing on establishing three key factors:

Providing connectivity across all functional areas with the production process for the purpose of integrating separate functional areas within an end-to-end system;

Automating processes and data collection activities; and
Using the production data for reconciliation and workflow management.

Implementation of these three key factors will establish a closed-loop information and control system that enables improved efficiencies and reduced costs.

DISCLOSURE OF THE INVENTION

The system of the present invention is based on an integrated architecture that includes an infrastructure built on processes, hardware, software and interfaces. The system is designed to monitor and control mail processing and data collection through a variety of manual and machine processes in real-time. The present invention uses computers, networks, web-based applications, databases and scanners to interface and integrate traditional mail processing equipment with customized software and a database repository. The present invention integrates the entire mail production process, as known by those of skill in the art of mail processing, to form and establish a complete system. Typical system components may include mainframe print manipulation software, such as Bell & Howell's Transformer™, Unix, and/or Microsoft NT file servers, and database management software and reporting software. Certain system operators would have system access from personal computers or other processing devices that are connected to or resident in mail processing devices. Management and other key personnel would have system access via a company wide Intranet driven by a browser on their personal computers. Direct access through a Local Area Network (LAN) connection is also an option available to system users. Network connections typically use, for example, Ethernet 10baseT running TCP/IP. These components would also be interfaced with corporate document management processes, software and equipment.

The present invention focuses on a job tracking data application. A job tracking application gathers data from each work station or mail processing device as materials pass through a defined route. Mail processing devices include, but are not limited to, inserters, sorters, postage meters, printers, rollers, and any other suitable devices for document processing. Using strategically placed barcodes,

data or a job (batch of material) is scanned as it enters and leaves the work area of a mail processing device thereby providing an audit trail. Data consolidation, another feature of the system, refers to collecting data from multiple mail processing devices. Data consolidation devices typically use high-end server computers using an Ethernet connection and a standard network protocol such as TCP/IP. Other connections and protocols are readily implementable, however.

Other hardware compatible for system use includes portable barcode labelers for tray tagging, and network printers for printing reports. Robust personal computers with data back-up units (e.g., zip drive) and auxiliary power supplies are recommended for network file servers. End-user personal computers need not be as robust as the network servers.

Open client/server system architecture and software is utilized as much as possible. Custom solutions are developable to integrate functions or provide functionality where none currently exists. For example, an interface between a data consolidation printer application and a job tracking application may require a custom fit.

The key to a successful system architecture is to identify processes and functions and build modular interfaces capable of collecting data and device information in real-time. Moving into an automated environment requires intelligence at the device level (regardless of the device type) in order to be able to communicate with a data collection device. Barcode readers and scanners (handheld or wand) are utilized in data collection. Whether mounted on equipment or hand-held, these devices enable data collection and processing to occur. Bell & Howell's Videotracker and Integrity Control System are examples of barcode readers for mail inserter devices.

Migrating to an Automated Messaging Factory environment requires the ability to actively manage and understand key production information in a real-time fashion across the entire mail production process. The ability to adjust and manage workflow issues before they impede schedule and cost targets is the added value of such an infrastructure. The present invention is focused on providing a job tracking system with a closed "feed-back" loop. A "closed loop" control system will achieve greater efficiencies and better performance, as opposed to an "open-loop" system because there is constant data verification. The present invention applies closed loop control theory to mail processing providing feedback and control features as a basis for the system architecture by using print stream data. Such a feedback loop provides operations management and supervisors with the ability to measure attributes known to those of skill in the art of mail processing, such as percent to complete for shift, job, etc., active status of work-in-progress (WIP) number of complete jobs or pieces, and essentially provide a full reconciliation of planned versus actual production.

With increased volumes and customer demands, the ability to track jobs through the print and finishing stages of mail processing is quite valuable and advantageous as is readily apparent to those of skill in the art. A factory control or job tracking system can automate the tedious function of data collection as work passes through each step on the mail processing route. These types of systems are connected real-time to other mail processing equipment across functional areas. For instance, Bell & Howell's Transformer™ mainframe print manipulation tool can read data from a print header page and format a barcode for printing. By printing a barcode on the first and last pages of output, jobs can be

tracked through mail processing stages. The jobs are scanned entering and leaving different mail processing areas to provide an audit trail in both mechanized and manual areas. Data is timely and accurate and can be used to monitor operator efficiency, quickly validate service level agreements, and generate monthly statistics. Large productivity gains can be realized by eliminating time-consuming manual data collection and report generation. Job tracking will collect data from mail processing devices as jobs are being processed and provide user access to the information through customized data applications which access the central server/database to mine data.

It is therefore an object of the present invention to provide a novel job tracking system for tracking data in automated document processing with particular application to the mail processing environment.

It is another object of the present invention to provide a common data collection facility for all functions within the mail processing environment.

It is a further object of the present invention to automate data collection for desired functional areas within the mail processing environment.

It is a still further object of the present invention to real-time status of current work in process and completed work across desired mail processing functional areas.

Some of the objects of the invention having been stated, other objects will become evident as the description proceeds, when taken in connection with the accompanying drawings described below.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing advantages and features of the present invention will be appreciated more fully from the following description with reference to the accompanying drawings in which:

FIG. 1 illustrates a functional block diagram showing the general flow of data for the present invention from mail processing device to data application;

FIG. 2 illustrates a communications environment linking the functional components of the present invention;

FIG. 3 illustrates the functions or processes in a typical mail processing job;

FIG. 4 illustrates a typical logon screen to gain access to the job tracking system of the present invention;

FIG. 5 illustrates the job tracking splash screen for the job tracking system of the present invention;

FIG. 6 illustrates a job tracking applet which provides options for the operator to select specific criteria through a set of five tabbed panels;

FIG. 7 illustrates the time tab panel within the job tracking applet;

FIG. 8 illustrates the batch panel within the job tracking applet;

FIG. 9 illustrates the operator panel within the job tracking applet;

FIG. 10 illustrates the machine panel within the job tracking applet;

FIG. 11 illustrates the stage panel within the job tracking applet;

FIG. 12 illustrates the batches panel that has been filled with the results of a query; and

FIG. 13 illustrates transactions for a particular batch.

BEST MODE FOR CARRYING OUT THE INVENTION

The present invention now is described more fully hereinafter with reference to the accompanying drawings, in

5

which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

Referring now to FIG. 1 and in accordance with the present invention, the centerpiece of the present invention is a computer server 10 and database 20 labeled IMPACT™ which stands for Integrated Message Processing And Communications Technology (hereinafter "server"). Use of the term server throughout this application also encompasses the database within the server. As is readily appreciated by those of skill in the art of mail processing, the server is where the information resides for data applications that will mine production data. The server also acts as the mechanism for tying all of the functional areas together in the existing mail production process. Data mining refers to software applications designed to selectively retrieve and organize data from the database into a desired format. The software applications can be standard off the shelf software programs or customized data applications developed for specific purposes.

The items identified on the left side of FIG. 1 represent an example of a mail production process from beginning to end. Other functions or processes may, however, exist and would be readily implementable within the scope of the present invention. In this example, ten (10) functions or processes (reference numbers 38-48) have been shown, however, not all ten functions or processes need be utilized in every mail processing environment. Certain mail processing environments may only require a subset of the processes or functions shown. Each process or function (30-48) may be a combination of physical mail processing devices and/or process steps. Each function or process is now briefly discussed.

The Media Selection 30 process selects the type of media for communication to the end customer. Some examples include paper document, compact disk, data file, and facsimile. The Message Formatting 32 function is used to format data for the particular media chosen in the media selection process discussed above. The Image Manipulation 34 process provides the ability to include or manipulate the formatted data with additional control codes in order to make the data more presentable. The Printing 36 function is where a document is created in paper form. Typically, the devices involved in this function are high volume, high speed printers. The Message Finishing 38 process is where final assembly of a message or document occurs. Automated and manual inserters are involved in this process. The Metering 40 function weighs completed mailpieces and applies the correct postage thereto for distribution. The Sorting 42 process, separates completed mailpieces into a pre-defined order. The pre-defined order usually relates to a postal regional group or zip-code order. The Distribution/Material Handling 44 function sends final documents to the customer. The Message Distribution 46 function routes messages to the end customer. The Response Management 48 function handles correspondence to and from the end customer such as returned material (e.g., payment or information requests).

The items identified on the right side of FIG. 1 represent software applications that can be developed for the mail processing environment for data mining purposes. Job tracking 50 and finite scheduling 52 are identified as data applications.

There are three fundamental concepts to be gleaned from the model of FIG. 1.

6

The data collection layer (IMPACT™ server) is critical to establish connectivity and access to production data; Mail processing steps are "linked" together to form an end-to-end system; and

Added value in the ability for growth and use of the data for job tracking.

It is to be understood that present invention illustrated herein is readily implementable by those of ordinary skill in the art as a computer program product having a medium with a computer program embodied thereon. The computer program product is capable of being loaded and executed on the appropriate computer processing device(s) in order to carry out the method or process steps described.

Referring now to FIG. 2, the present invention can be implemented in a variety of communications environments. These include Local and Wide Area Network (LAN/WAN) environments, a company-wide Intranet, the Internet, and a dial-up connection among others. The present invention can be implemented, inter alia, in communications environments utilizing a TCP/IP communications protocol and environments utilizing SNA protocol. Hardware for implementing the present invention is consistent with typical personal computing equipment, and does not generally require specific environmental conditions. FIG. 2 illustrates some examples of system connectivity that permit system-wide access to the server. The IMPACT™ server 100 is the centerpiece of the present system. Server 100 is a fairly high end processing/communications/storage device having a database resident therein and multiple communications ports capable of communicating over a variety of medium using a variety of standard or even customized protocols. A feature of the system is the ability to access server 100 in just about any conceivable manner. Server access is required for two main purposes. First, data entry devices such as mail processing devices (MPDs) 300 themselves, or bar code scanners (BCSs) 400 must be able to relay data they generate to server 100 in order to populate the database resident therein. Second, software applications (APPLs) 500 must be able to access that database via server 100 for data mining purposes.

For instance, server 100 can be linked to the Internet 200 thereby providing access to server 100 from any device capable of connecting to the Internet 200. A local area network (LAN) 205 could have access to the Internet 200. Further, mail processing devices 300, bar code scanners 400 (or other data entry devices), and software applications 500 can be connected to LAN 205 and gain access to server 100 via the Internet 200. Moreover, mail processing devices 300 and data entry devices 400 can connect to the Internet 200 directly or through a software application 500. In the above described connectivity schemes, a company-wide Intranet 210 or other packet data network 230 may be substituted for the Internet. Or, the company-wide Intranet 210 may be added to the Internet 200 schemes providing even greater flexibility in accessing server 100. Similarly, a local area network (LAN) 220 can be directly connected to server 100. Mail processing devices 300, data entry devices 400, and software applications 500 can then access the server through local area network 220. It is also possible to have mail processing devices 300, data entry devices 400, and software applications 500 connected directly to server 100. Lastly, a mainframe, or enterprise system, connection 600 can be linked to a software application and ultimately to server 100.

The foregoing connectivity schemes are illustrative only. One of ordinary skill in the art could readily devise and implement alternate network connections to server 100 without departing from the spirit or scope of the present invention.

A job tracking system needs to be able to allow a user to track a mailpiece through each stage of the physical plant and optimize or schedule work based on a multitude of variables. In order to meet these criteria, the job tracking system of the present invention understandably requires data regarding jobs, operators, mail processing devices, and/or other suitable data parameters typically and conventionally involved in mail processing.

A list of job tracking capabilities/requirements is presented hereinbelow. The list is not intended to be limiting as more suitable capabilities can be added to the job tracking software application on an as needed basis in accordance with the present invention. For purposes of the present disclosure, however, the following twelve (12) areas have been identified for job tracking, as described hereinbelow.

The job tracking system of the present invention will track jobs and mailpiece counts for actual daily volumes. The job tracking system will track the actual daily volumes in an roll-up fashion and provide breakouts for machine volume totals as well as manual totals. The job tracking system will capture statistical and actual data for individual operators and mail processing devices. The job tracking system will account for general diverts and other types of diverts. For example, the number of errors, holds, or overweight pieces. The job tracking system will be able to perform a job breakdown per application per cycle. The job tracking system will track and provide an indication when a special insert required additional postage for a mailpiece. The job tracking system will perform account level tracking. The job tracking system will be able to perform piece level verification for integrity purposes. The job tracking system will track production statistics for all inserter devices connected to the network. The job tracking system will correlate print area job names and statement processing area job names into a common job naming scheme. The job tracking system will have query capability with access to job and account level data. The job tracking system will automate the statement rendering process (custom specific) in order to eliminate manual tracking errors. Thus, the job tracking system of the present invention is capable of organizing and providing job status for an entire job or for subsets of interest within the entire job depending on the nature of a database query of a user.

The overall system will have at least three (3) levels of security: operator, supervisor, and manager. Moreover, access to the system is defined functionally, such as, for instance, view jobs, indicate job start and completion, number of mailpieces, generate reports, print, enter new job data, enter new device data, enter new process data, enter new operator data, update existing data, request re-optimization (scheduling), view historical data, and plan capacity. A system administrator has the ability to define which of the functions would be available to each of the security levels (operator, supervisor, and manager). One possible scenario is shown in the table below.

SECURITY LEVEL	FUNCTION
Operator	View, Indicate Job Completion
Supervisor	Print, Generate Reports, Enter Mailpieces Processed, Enter Completed Times, Enter Comments
Manager	Enter New Jobs, Enter New Data, Update Existing Data

Each level of security would have access to the system as defined by the system administrator and also to lesser

security level functions. Thus, managers would have access to all three security levels while operators would only have access to their own level. Supervisors would have access to the supervisor and operator level but not the manager level of security. Other security layers may be added accordingly.

The system also provides for automatic data archival. All data is archived on the server as well as locally to the user's machine. Transactional data can be archived daily to the server and can be archived elsewhere. Users are able to define suitable periods for archiving (e.g., daily, weekly, monthly, semi-annually, annually), and users are also able to access the archived data. A user can look forward one year for larger capacity planning job scheduling purposes. Moreover, the system can copy and/or clear previous data.

On recurring jobs, a user needs to be able to increase or decrease the expected input/output of that job. For example, if an operator ran jobs 1-5 each month last year and the forecast for the coming year indicates that jobs 1-5 will be increased by x%, then the operator will be able to automatically optimize the system to meet the increased needs.

Data is entered into the server in a variety of ways as previously discussed. Direct entry from each mail processing device in as near a real-time fashion as possible is most preferable. Handheld data entry devices (e.g. barcode scanners) are also utilized. Manual data entry is permitted when necessary. Data to be entered into the system includes data pertaining to processes (e.g., print, fold, insert, tray) and jobs (e.g., size, expected arrival date, actual arrival date, number of inserts, types of materials needed, and/or other suitable data.).

The types of mail processing devices and their respective feature sets will be configurable at the system level. Broad categories such as printers, inserters, sorters, roll systems, and/or other suitable categories can be defined. Within each category, the user will be able to identify specific devices present at a given site and be able to define the feature sets of the devices.

The system provides a real-time view of various job and scheduling status information viewable at a computer monitor. Thus, a supervisor or manager can instantaneously see if a job is falling behind its expected schedule. Reports can be generated based on a variety of sortable criteria including, but not limited to, operator, device, job, mailpieces processed, completed jobs, functional area, and/or other suitable criteria. Sorts can be layered as primary and secondary. Thus, a manager can, for instance, pull up a certain mail processing device operator in a primary sort and then call up all jobs assigned to that operator as a secondary sort. Many variations of accessing data and generating reports is available. Some examples include: jobs completed within a certain time period, printing generated reports, links to other software applications, combining data pertaining to a single job spanning multiple devices into a single report, and user defined report customization. The reports may be output to a printer, a data file to a floppy or hard disk, CD-ROM, facsimile, e-mail, or any other format well known in the art.

Job tracking is a software application that mines raw data from the server that has been gathered from various data entry devices and/or mail processing devices and stored within the server's database.

Using barcodes is one way to automate the tracking of jobs and/or accounts in a mail processing environment. Mainframe print manipulation software reads the print output jobs and statements and converts key data into barcodes in the output file. If jobs and accounts will be tracked, then both job barcodes and account barcodes will be required. A job barcode will be inserted on the header page of a print job

and include information such as date, region, type and range. The job barcode will be read with a hand-held scanner at the machine or manual inserter stations and the data will be transferred to the server for tracking purposes. For account tracking, barcodes will be placed on each statement, for instance, and contain the account number, cycle, and application. As statements are being inserted, a machine reader will scan the account barcode and send the data to the server for tracking. This provides the ability to identify which jobs or accounts have been completed through the inserting stage.

In addition to automating the data collection from the inserters, daily processing and operational statistics for manual inserting and exceptions handling will also be collected and stored in the server. By providing customized templates for data entry, operators can log in with a unique code and scan or directly enter the information into the server. This will eliminate the requirement for working from paper reports or recording their results on paper forms. The benefit of collecting this information in the server is that it eliminates much of the manual effort and time spent on gathering daily statistics and preparing detail/summary reports. In addition, it improves data accuracy by using scanners in place of hand written logs.

For manual inserting, operators will scan the job barcode to indicate it is being worked on, scan the barcode for the accounts as they complete manual insertion and finally scan the job barcode again to indicate that the job is finished.

Automating the manual area also provides electronic data on operator workloads. Because operators will log in, as they do on the inserting machines, work statistics will be accumulated during the shift and be available for review when the shift ends. Once the data is captured, it can be summarized for input into other reports.

A primary objective of the server is to maintain a central repository of mail processing data that multiple people can access for data entry, review, update and generate custom reports. By collecting both mail processing device and manual data with input devices, essential data will be stored for immediate or later use. Data will be automatically available for statistical reporting such as volumes counts at detail and summary levels. Once device data is available, inputting barcode data with scanners in non-machine areas will provide a way to track jobs and accounts processed manually, such as highs and exceptions. With the processing data stored in the system, custom reports can be developed, saved and quickly regenerated when needed. This will improve the data accuracy and greatly reduce the time it takes to gather and create reports on a regular basis. Specialized reports can be generated for specific one time information needs.

The integrated solution described above will automate the collection of data from a variety of manual and machine processes as they occur so management and operators can use the data for decision making and report generation. Using barcodes in some processes helps maintain data integrity. Using computer data entry templates in other processes and machine generated statistics from the inserters, provides a timely electronic way to record and store data for later use. Combining these methods gives the user the ability to track jobs and accounts through their internal mail process and positions them to improve their own internal operations and external customer service.

Job tracking is viewed as an integrated, modular, scalable software solution that provides mail processing personnel a way to track and analyze work as it moves through production. The preferred embodiment of the system is

broken into the following major functional sub-systems: database design, configuration module, utility module, viewer module, and report designer module. Such major functional sub-systems are, however, not the only ones which could exist. Other functional areas may be developed according to specific client needs and readily incorporated within the scope of the present invention.

A data map is designed depicting the data relations and data flow necessary for all Interface Modules for a given mail processing environment. Once the data map has been developed development of the database scheme can occur.

The configuration module of the job tracker system allows supervisory personnel to tailor a job tracking application to fit a specific mail-processing environment. The configuration module will allow the user to design a mail process map that depicts the current mail process, edit the mail process map, create job-naming schema for the database. The configuration module further allows the user to graphically design a process map by defining objects representing individual process areas, referred to as stages, onto a process flow map. Once a stage is defined, the user can double click on that stage to edit its properties. Stage properties will contain the stage name and a description. Optional properties for the stage might include the type of the machines contained within a stage and their network address. The application will have a generic stage object to represent process areas. Once the user has completed the process map, it can be saved. When the map is saved, database tables are created from that map according to object properties. The user then has the ability to edit the map to reflect changes in the process.

A user can create job-naming schema within the configuration module by selecting the Job Name button. When the Job Name button is selected the job-naming screen will be displayed. The user can then input the number of levels for the job name and name each level. The user will also have the option to create a runtag from the concatenation of all the level names or have the job tracking program create a unique runtag.

A user can also enter the user manager by selecting the Manager user buttons. When the user button is depressed the manager user screen will be displayed, providing the current user logged on has system administration privileges. This screen will display a table containing all the users configured in the application and their respective security levels. The user can then add, edit, and delete users accordingly. Each of these functions will have a respective button that displays a pop-up window to perform the requested task.

The job viewer module provides the user with a visual front end to the database. The job viewer allows the user to display a snapshot, including status, of the job selected. The user will be able to drill down to details about that job via the naming convention established in the configuration module to view smaller segments or batches contained within that particular job. There is a graphical mode or text mode, user selectable, representation displayed for each detail level requested by the user. The data depicts what percentage of material has been completed at each stage.

The stage viewer module allows the user to view process statistics particular to a requested stage. Initially, a stage viewer for an inserter process is included. Additional stage viewers for other stages are developable according to customer needs.

The report viewer module has a menu from which the user will select pre-configured reports. When the user selects a report it will be displayed. The report viewer will also have a simple report creation interface where the user can build

queries or type SQL statements to display customer reports on-line. An option to save custom reports can be selected by the operator.

The report viewer is used to intergrate reporting into the job tracking system. And should provide easy-to-use, object-oriented access to the entire database engine. Users can create ad hoc reports and queries themselves, or access existing reports and queries. If a user creates a report or query, they will have the option of adding the report to the existing list of reports for future use.

In general, per the preferred embodiment, the software will be designed around client-server architecture. The server operating system can be from Microsoft, Novell, or another brand. The database and web server software shall run on the server. Clients comprise workstation capable of running web browsing software such as, for example, Microsoft Internet Explorer, Netscape Communicator, or the like. The client software shall be implemented with a combination of HTML, scripting and the JAVA programming language. The Report designer preferably uses Crystal Reports or Oracle Report Writer. Equivalents of the foregoing system components are readily implementable into the present invention without departing from the spirit or scope thereof.

FIG. 3 illustrates the functions or processes involved in tracking a typical mail processing job. The job tracking application first establishes a job naming scheme 700 and establishes all the process steps that the job will involve. Next, a barcode representation for the job naming scheme is created 710. A barcode is then placed on the control document, or header page 720. The header page or control document is printed 730 with the job. A mail processing job process is then started 740 by scanning the "begin header page". The mail processing job process is terminated 750 by scanning the "end page". A check 760 is made to determine if there are any remaining processes for the mail processing job. If so, the next job process is started 740 by scanning the "begin header page". Meanwhile, job status is continually able to be received 770 during execution of the mail processing job from supervisory systems.

The job tracking system assists an operator in tracking the status of a job and batches within that job. Under the preferred embodiment, an operator will view the job tracking system through a graphical user interface (GUI) in the form of a Java applet running in a web browser. The applet has the ability to allow the operator to make multiple selections based on batch, operator, etc. and run a query. The applet connect to the server/database and retrieves and displays the requested information. For purposes of illustration, the job tracking applet is shown running in a Netscape web browser, however, this applet will also run in Microsoft's Internet Explorer and Sun's HotJava browser, or any other java enabled browser application.

Prior to running the job tracking applet, the operator must first logon to the server. FIG. 4 illustrates a typical logon screen which asks for a "user name" 800 and a "password" 802. Upon verification, the user is granted access to the job tracking system. This provides a measure of security in that not just anyone can view the job tracking information.

Following the logon pop-up screen, the operator sees the job tracking splash screen of FIG. 5. This is an informational screen stating this is the Bell & Howell IMPACT™ job tracking system. It also contains a button 806 to launch the job tracking applet.

Referring now to FIG. 6, the job tracking applet provides options for the operator to select specific criteria through a set of five tabbed panels: Time 808, Batch 810, Operator

812, Machine 814, and stage 816. Each tab contains options that serve to build an SQL query to the database. Once the selections are completed, the operator then clicks the "Run Query" button 818. The query results are displayed in the "BATCHES" panel 820 located below the tab panels. The results show all the batches associated with the selection criteria given in the tabbed panels and is sorted by the Group 822 of the Batch ID. The "SUMMARY" panel 824, located directly below the batch information panel, displays the number of batches, number of envelopes, and the number of pages. Should the operator want to run a new query, a "Clear Results" button 826 is provided to clear the "BATCHES" and "SUMMARY" panels. This resets the panel, thereby clearing the way for a new set of results to be displayed after a new query has been run. At the bottom of the screen shot there is a "Show Transactions!" button 827. This button will display the transactions associated with a particular batch. To view the transactions of a batch, click on a row to highlight it and then click on the "Show Transactions!" button 827.

The time tab panel, illustrated in FIG. 7, includes options for "ALL" to the "Last 5 Days" in a choice pull-down box 828. The batch tab panel, illustrated in FIG. 8, contains four choice boxes; Group 830, Statement ID 832, Statement Type 834, and Batch Number 836. The operator will work from left to right making the desired selections. If the operator needs to go back to a previous choice box, the selections of the following choice boxes will change. The operator tab panel, illustrated in FIG. 9, contains a choice box 838 of all possible operators. The operator may also select 'ALL' to review the work done by all operators. The machine tab panel, illustrated in FIG. 10, contains a choice box 840 of all the machines for which information can be retrieved. The stage tab panel, illustrated in FIG. 11, contains two sub panels; a production route panel 842 and a stage panel 844. The production route panel contains three radio buttons for the types of production routes that exist for a given customer. The stage panel contains five radio buttons for this particular customer; Any Stage, Printing, Waiting for Inserting, Inserting, and Completed Inserting.

FIG. 12 illustrates the batches panel 820 that has been filled with the results of a query. Note the summary panel 824 has the overall totals for the query.

FIG. 13 illustrates transactions for a particular batch. Transactions include "Startinsert" 846 and "FinishInsert" 848, since only inserters are tracked in the present example. At the bottom of this screen, the operator can click the "Return to Batch Query" button 850 and return to the screen of FIG. 7.

Appropriate computer program code in combination with hardware implements many of the elements of the present invention. This computer code is often stored on storage media. This media can be a diskette, hard disk, CD-ROM, or tape. The media can also be a memory storage device or collection of memory storage devices such as read-only memory (ROM) or random access memory (RAM). Additionally, the computer program code can be transferred to the appropriate hardware over some type of data network.

The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims.

13

In the claims, any means-plus-function clauses are intended to cover the structures described herein as performing the recited function and not only structural equivalents but also equivalent structures. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the appended claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

What is claimed:

1. A method for tracking job data for document processing, the method comprising:
 - (a) gathering mailpiece processing job data from a plurality of mailpiece processing devices pertaining to status of a mailpiece or mailpiece processing job and storing the mailpiece processing job data in a server database, wherein the gathering and storing occur in real-time during mailpiece processing by the mailpiece processing devices;
 - (b) providing real-time access to the mailpiece processing data stored in the server database; and
 - (c) providing a real-time view of the data stored in the server database.
2. The method of claim 1 wherein the mailpiece processing job data is gathered directly from the mailpiece processing devices.
3. The method of claim 1 wherein the mailpiece processing job data is gathered from bar code scanning devices associated with the mailpiece processing devices.
4. The method of claim 1 wherein the database is physically located remote from the mailpiece processing devices and receives the gathered job data from the mailpiece processing devices via a computer network link.
5. A method for mining data from a server database possessing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from at least one mailpiece processing device and stored in the server database in real-time during execution of a mailpiece processing job, the method comprising:
 - (a) providing real-time access to the data stored in the server database;
 - (b) providing a real-time view of the data stored in the server database;
 - (c) selectively retrieving, in real-time, data relating to execution of a mailpiece processing job from the server database, and
 - (d) organizing the retrieved data into a desired format.
6. The method of claim 5 further comprising outputting the organized data.
7. The method of claim 5 wherein the access to the server database is achievable from a remote location through a computer network link.
8. The method of claim 7 wherein the data is selectively retrieved and transferred to a local processing device for organization into a desired format.
9. The method of claim 5 wherein a definable subset of job or mailpiece status data is selectable based on pre-defined job naming characteristics.
10. A method for mining data from a server database possessing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the method comprising:

14

- (a) providing real-time access to the server database, wherein the access is determinable based on pre-definable security levels;
 - (b) providing a real-time view of the data stored in the server database;
 - (c) selectively retrieving, in real-time, data relating to execution of a mailpiece processing job from the server database; and
 - (d) organizing the retrieved data into a desired format.
11. A system for tracking mailpiece or job status data within an entire mail processing facility or system, the system comprising:
 - (a) a plurality mailpiece processing devices for processing at least one mailpiece or mailpiece processing job;
 - (b) a server database operatively connected to the mailpiece processing devices for receiving and storing status data pertaining to a mailpiece or mailpiece processing job in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing device; and
 - (c) a processing device operatively associated with the server database for providing a real-time view of the data stored in the server database.
 12. The system of claim 11 wherein the data is received directly from the mailpiece processing devices.
 13. The system of claim 11 wherein the data is received from bar code scanning devices associated with the mailpiece processing devices.
 14. The system of claim 11 wherein the server database is physically located remote from the mailpiece processing devices and receives the data from the mailpiece processing devices via a computer network link.
 15. A system for mining data from a server database possessing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the system comprising:
 - (a) a server database possessing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from a plurality of mailpiece processing devices and stored in the database in real-time; and
 - (b) a processing device operatively connected to the database for providing a real-time view of the data stored in the server database and selectively retrieving, in real-time, the data pertaining to at least one mailpiece processing job or mailpiece.
 16. The system of claim 15 wherein access to the server database by processing device is achievable from a remote location through a computer network link.
 17. The system of claim 15 wherein the retrieved data is organized into a desired format.
 18. The system of claim 15 wherein a definable subset of job or mailpiece status data is selectable based on pre-defined job naming characteristics.
 19. A system for mining data from a server database for processing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the system comprising:
 - (a) a server database for receiving and storing, in real-time, data pertaining to at least one mailpiece processing job or mailpiece by a plurality of mailpiece processing devices, wherein access to the server database is determinable based on pre-definable security levels; and

15

(b) a processing device operatively connected to the server database for providing a real-time view of the data stored in the database and for selectively retrieving, in real-time, the data pertaining to at least one mailpiece processing job or mailpiece.

20. A method for tracking mailpiece or job status data within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or mailpiece processing job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or mailpiece processing job status data being gathered from a plurality of mailpiece processing devices during execution of a mailpiece processing job, the method comprising:

(a) gathering data pertaining to the status of a mailpiece or mailpiece processing job and storing the data in a server database in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing devices in the mailpiece processing system;

(b) providing real-time access to the data stored in the server database;

(c) providing a real-time view of the data stored in the server database;

(d) selectively retrieving data from the database; and

(e) organizing the retrieved data into a desired format.

21. The method of claim 20 wherein the data is gathered directly from the mailpiece processing devices.

22. The method of claim 20 wherein the data is gathered from a bar code scanning device associated with the mailpiece processing devices.

23. The method of claim 20 wherein the server database is physically located remote from the mailpiece processing device and receives the gathered data from the mailpiece processing devices via a computer network link.

24. The method of claim 20 wherein the access to the server database is achievable from a remote location through a computer network link.

25. The method of claim 24 wherein the data is selectively retrieved and transferred to a local processing device for organization into a desired format.

26. The method of claim 20 wherein a definable subset of job or mailpiece status data is selectable based on pre-defined job naming characteristics.

27. A method for tracking mailpiece or job status data within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or mailpiece processing job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or mailpiece processing job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the method comprising:

(a) gathering data pertaining to the status of a mailpiece or mailpiece processing job and storing the data in a server database in real-time as the mailpiece or mailpiece processing job is processed by a plurality of mailpiece processing devices in the mailpiece processing system;

(b) providing real-time access to the data in the server database, wherein the access to the database is determinable based on pre-definable security levels;

(c) providing a real-time view of the data stored in the server database;

(d) selectively retrieving data from the database; and

(e) organizing the retrieved data into a desired format.

28. A system for tracking mailpiece or mailpiece processing job status within an entire mailpiece processing facility

16

or system and mining data from a server database possessing mailpiece or job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the system comprising:

(a) a plurality of mailpiece processing devices for processing at least one mailpiece or mailpiece processing job;

(b) a server database operatively connected to the mailpiece processing devices for receiving status data pertaining to a mailpiece or mailpiece processing job in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing devices; and

(c) a processing device operatively connected to the server database for providing a real-time view of the data stored in the server database and selectively retrieving, in real-time, data pertaining to at least one mailpiece processing job.

29. The system of claim 28 wherein the mailpiece or mailpiece processing job status data is received directly from the mailpiece processing devices.

30. The system of claim 28 wherein the mailpiece or mailpiece processing job status data is received from a bar code scanning device associated with the mailpiece processing devices.

31. The system of claim 28 wherein the server database is physically located remote from the mailpiece processing devices and receives the data from the mailpiece processing device via a computer network link.

32. The system of claim 28 wherein access to the server database by the mailpiece processing devices is achievable from a remote location through a computer network link.

33. The system of claim 28 wherein the retrieved data is organized into a desired format.

34. The system of claim 28 wherein a definable subset of job or mailpiece status data is selectable based on pre-defined job naming characteristics.

35. A system for tracking mailpiece or mailpiece processing job status within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the system comprising:

(a) a plurality of mailpiece processing devices for processing at least one mailpiece or mailpiece processing job;

(b) a server database operatively connected to the mailpiece processing devices for receiving and storing status data pertaining to a mailpiece or mailpiece processing job in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing devices wherein access to the server database is determinable based on pre-definable security levels; and

(c) a processing device operatively connected to the server database for providing a real-time view of the data stored in the server database and selectively retrieving, in real-time, data pertaining to at least one mailpiece processing job.

36. A computer program product for tracking mailpiece or mailpiece processing job status within an entire mailpiece processing facility or system and mining data from a server

17

database possessing mailpiece or mailpiece processing job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the computer program product having a medium with a computer program embodied thereon, the computer program product comprising:

- (a) computer program code for gathering data pertaining to the status of a mailpiece or mailpiece processing job and storing the data in a server database in real-time as the mailpiece or mailpiece processing job is processed by a plurality of mailpiece processing devices in the mailpiece processing system;
- (b) computer program code for providing real-time access to the data in the server database;
- (c) computer program code for providing a real-time view of the data stored in the server database;
- (d) computer program code for selectively retrieving data from the server database; and
- (e) computer program code for organizing the retrieved data into a desired format.

37. The computer program product of claim 36 further comprising computer program code for outputting the organized data.

38. A method for tracking job data for document processing, the method comprising:

- (a) gathering mailpiece processing job data from a plurality of mailpiece processing devices pertaining to status of a mailpiece or mailpiece processing job and storing the mailpiece processing data in a server database in real-time during mailpiece processing by the mailpiece processing devices, wherein gathering job data from the mailpiece processing devices includes gathering job data from a mailpiece inserter;
- (b) providing real-time access to the job data stored in the server database; and
- (c) providing a real-time view of the job data stored in the server database.

39. A method for tracking job data for document processing, the method comprising:

- (a) gathering mailpiece processing job data from a plurality of mailpiece processing devices pertaining to status of a mailpiece or mailpiece processing job and storing the job data in a server database in real-time during mailpiece processing by the mailpiece processing devices, wherein gathering job data from the mailpiece processing devices includes gathering job data from a mailpiece sorter;
- (b) providing real-time access to the job data stored in the database; and
- (c) providing a real-time view of the data stored in the server database.

40. A method for mining data from a server database for processing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the method comprising:

- (a) providing real-time access to the server database;
- (b) providing a real-time view of the data stored in the server database;
- (c) selectively retrieving data relating to execution of a mailpiece processing job from the server database; and
- (d) organizing the retrieved data into a desired format, wherein selectively retrieving data relating to execution

18

of a mailpiece processing job comprises selectively retrieving data relating to mailpiece inserting.

41. A method for mining data from a server database for processing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the method comprising:

- (a) providing real-time access to the server database;
- (b) providing a real-time view of the data stored in the server database;
- (c) selectively retrieving data relating to execution of a mailpiece processing job from the server database; and
- (d) organizing the retrieved data into a desired format, wherein selectively retrieving data relating to execution of a mailpiece processing job comprises selectively retrieving data relating to mailpiece sorting.

42. A system for tracking mailpiece or job status data within an entire mail processing facility or system, the system comprising:

- (a) a plurality of mailpiece processing devices for processing at least one mail or mailpiece processing job;
- (b) a server database operatively connected to the mailpiece processing devices for receiving and storing status data pertaining to a mailpiece or mailpiece processing job in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing devices, wherein the mailpiece processing devices include a mailpiece inserter; and
- (c) a processing device coupled to the server database for providing a real-time view of the status data stored in the server database.

43. A system for tracking mailpiece or job status data within an entire mail processing facility or system, the system comprising:

- (a) a plurality of mailpiece processing devices for processing at least one mail or mailpiece processing job; and
- (b) a server database operatively connected to the mailpiece processing devices for receiving and storing status data pertaining to a mailpiece or mailpiece processing job in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing devices, wherein the mailpiece processing devices include a mailpiece sorter; and
- (c) a processing device coupled to the server database for providing a real-time view of the status data stored in the server database.

44. A system for mining data from a database possessing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from a plurality of mailpiece processing devices and stored in the database in real-time during execution of a mailpiece processing job, the system comprising:

- (a) a server database for gathering and storing data pertaining to at least one mailpiece processing job or mailpiece by a plurality of mailpiece processing devices, the data being gathered and stored in real-time during processing of the mailpiece processing job; and
- (b) a processing device operatively connected to the server database for providing a real-time view of the data stored in the server database and for selectively retrieving, in real-time, data pertaining to at least one mailpiece processing job or mailpiece, wherein the processing device is adapted to retrieve data pertaining to a mailpiece inserting job from the server database.

45. A system for mining data from a server database for processing data pertaining to at least one mailpiece processing job or mailpiece, the data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the system comprising:

- (a) a server database for gathering and storing data pertaining to at least one mailpiece processing job or mailpiece by a plurality of mailpiece processing devices, the data being gathered and stored in real-time during processing of the mailpiece processing job; and
- (b) a processing device operatively connected to the server database for providing a real-time view of the data stored in the server database and for selectively retrieving, in real-time, data pertaining to at least one mailpiece processing job or mailpiece, wherein the processing device is adapted to retrieve data pertaining to a mailpiece sorting job from the database.

46. A method for tracking mailpiece or job status data within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or mailpiece processing job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or mailpiece processing job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the method comprising:

- (a) gathering data pertaining to the status of a mailpiece or mailpiece processing job and storing the data in the server database in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing devices in the mailpiece processing system;
- (b) providing real-time access to the server database;
- (c) providing a real-time view of the data stored in the server database;
- (d) selectively retrieving data from the server database; and
- (e) organizing the retrieved data into a desired format, wherein gathering data pertaining to the status of a mailpiece or job as it is processed by the mailpiece processing devices includes gathering data from a mailpiece inserter.

47. A method for tracking mailpiece or job status data within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or mailpiece processing job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or mailpiece processing job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the method comprising:

- (a) gathering data pertaining to the status of a mailpiece or mailpiece processing job and storing the data in a server database in real-time as the mailpiece or mailpiece processing job is processed by a plurality of mailpiece processing devices in the mailpiece processing system;
- (b) providing real-time access to the server database;
- (c) providing a real-time view of the data stored in the server database;
- (d) selectively retrieving data from the server database; and
- (e) organizing the retrieved data into a desired format, wherein gathering data pertaining to the status of a mailpiece or job as it is processed by the mailpiece

processing devices includes gathering data from a mailpiece sorter.

48. A system for tracking mailpiece or mailpiece processing job status within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the system comprising:

- (a) a plurality of mailpiece processing devices for processing at least one mailpiece or mailpiece processing job;
- (b) a server database operatively connected to the mailpiece processing devices for receiving and storing status data pertaining to a mailpiece or mailpiece processing job in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing devices; and
- (c) a processing device operatively connected to the server database for providing a real-time view of the status data stored in the server database and selectively retrieving, in real time, data pertaining to at least one mailpiece processing job, wherein the mailpiece processing devices include a mailpiece inserter.

49. A system for tracking mailpiece or mailpiece processing job status within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or job status data gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the system comprising:

- (a) a plurality of mailpiece processing devices for processing at least one mailpiece or mailpiece processing job;
- (b) a server database operatively connected to the mailpiece processing devices for receiving and storing status data pertaining to a mailpiece or mailpiece processing job in real-time as the mailpiece or mailpiece processing job is processed by the mailpiece processing devices; and
- (c) a processing device operatively connected to the server database for providing a real-time view of the status data stored in the server database and selectively retrieving, in real-time, data pertaining to at least one mailpiece processing job, wherein the mailpiece processing devices include a mailpiece sorter.

50. A computer program product for tracking mailpiece or mailpiece processing job status within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or mailpiece processing job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the computer program product having a medium with a computer program embodied thereon, the computer program product comprising:

- (a) computer program code for gathering data pertaining to the status of a mailpiece or mailpiece processing job and storing the data in a server database in real-time as the mailpiece or mailpiece processing job is processed by a plurality of mailpiece processing devices in the mailpiece processing system;

21

- (b) computer program code for providing real-time access to the server database;
- (c) computer program code for providing a real-time view of the data stored in the server database;
- (d) computer program code for selectively retrieving data from the server database; and
- (e) computer program code for organizing the retrieved data into a desired format, wherein the computer program code for gathering data pertaining to the status of a mailpiece or mailpiece processing job as it is processed by the mailpiece processing devices in the mailpiece processing stream includes computer program code for gathering data from a mailpiece inserter.

51. A computer program product for tracking mailpiece or mailpiece processing job status within an entire mailpiece processing facility or system and mining data from a server database possessing mailpiece or mailpiece processing job status data pertaining to at least one mailpiece processing job or mailpiece, the mailpiece or job status data being gathered from a plurality of mailpiece processing devices and stored in the server database in real-time during execution of a mailpiece processing job, the computer program product having a medium with a computer program embodied thereon, the computer program product comprising:

22

- (a) computer program code for gathering data pertaining to the status of a mailpiece or mailpiece processing job and storing the data in a server database in real-time as the mailpiece or mailpiece processing job is processed by a plurality of mailpiece processing devices in the mailpiece processing system;
- (b) computer program code for providing real-time access to the server database;
- (c) computer program code for providing a real-time view of the data stored in the server database;
- (d) computer program code for selectively retrieving data from the server database; and
- (e) computer program code for organizing the retrieved data into a desired format, wherein the computer program code for gathering data pertaining to the status of a mailpiece or mailpiece processing job as it is processed by the mailpiece processing devices in the mailpiece processing system includes computer program code for gathering data from a mailpiece sorter.

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US006327515B1

(12) **United States Patent**
Shea et al.

(10) Patent No.: **US 6,327,515 B1**
(45) Date of Patent: **Dec. 4, 2001**

(54) **PERFORMANCE TUNING OF AN INSERTER SYSTEM BASED UPON A ROLLING AVERAGE OF PAGE COUNTS FOR MAILPIECES TO BE PROCESSED**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/474,824**

(22) Filed: **Dec. 29, 1999**

(51) Int. Cl.⁷ **G06F 7/00**

(52) U.S. Cl. **700/221; 700/220; 270/52.02**

(58) Field of Search **700/220, 221, 700/223, 224, 225; 270/52.02**

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(57) **ABSTRACT**

An apparatus for assembling mailpieces and a method for controlling such apparatus. The apparatus includes a document feeder for feeding sets of documents to a chassis for assembly into mailpieces a constant rate. Because the number of documents varies the time to assemble a set varies and it is possible that a set may not be available when the chassis is ready to cycle; resulting in a cycle in which no mailpiece is processed. To correct for this the average number of documents for a number of mailpieces to be processed is determined and a nominal chassis speed and cycling rate are determined correspondingly. The actual chassis speed is then periodically updated to approach the nominal speed.

20 Claims, 5 Drawing Sheets

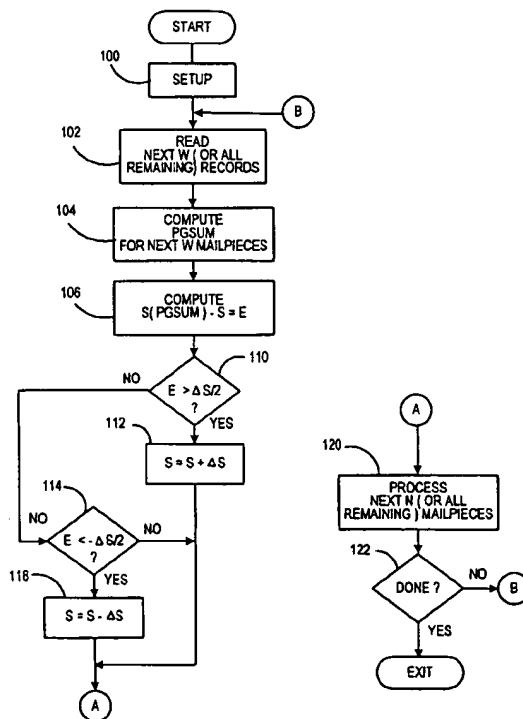
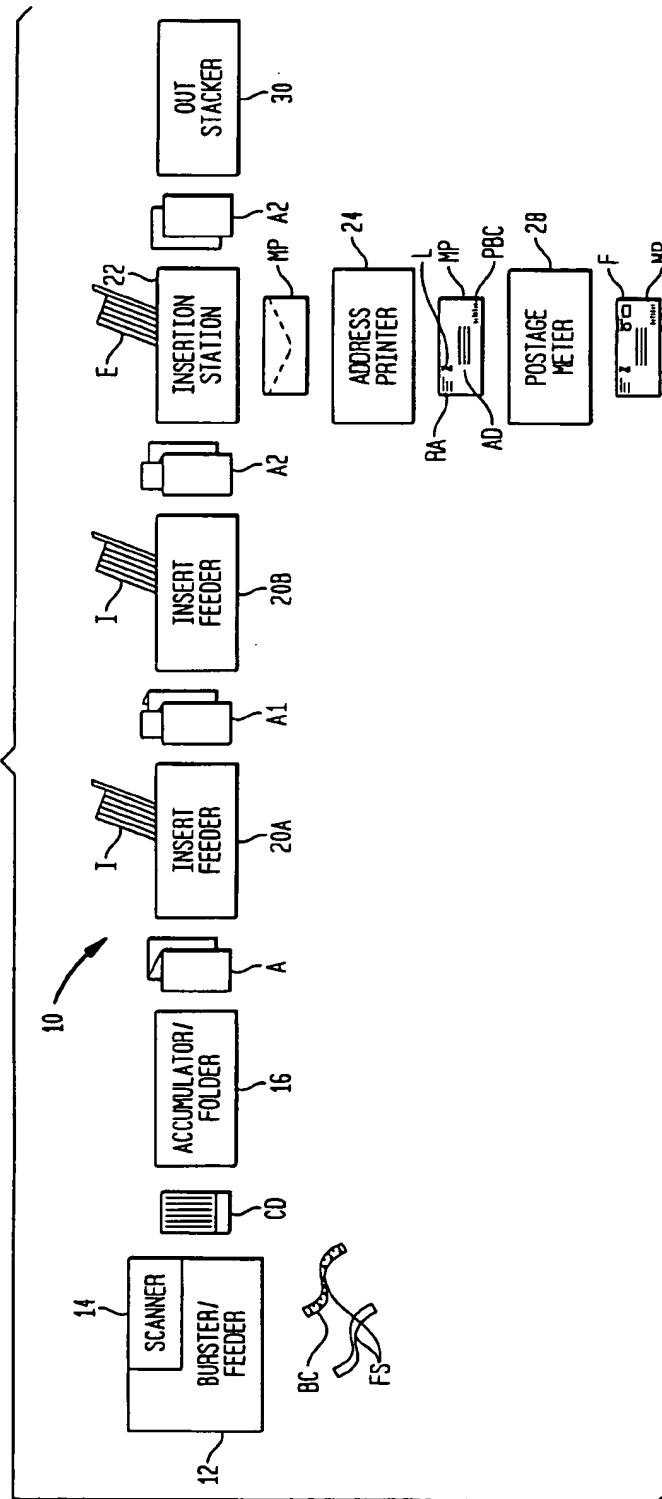
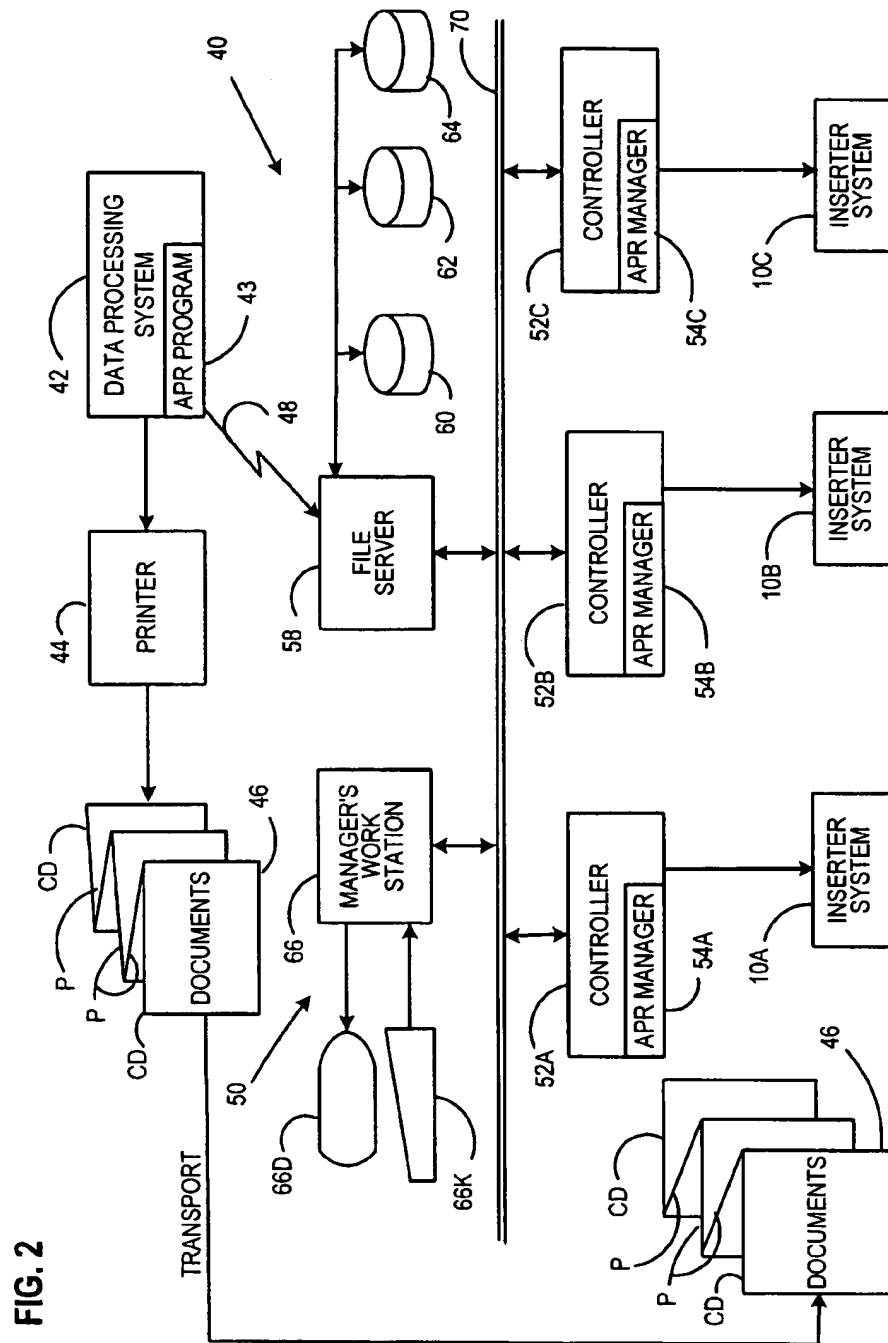


FIG. 1
(PRIOR ART)





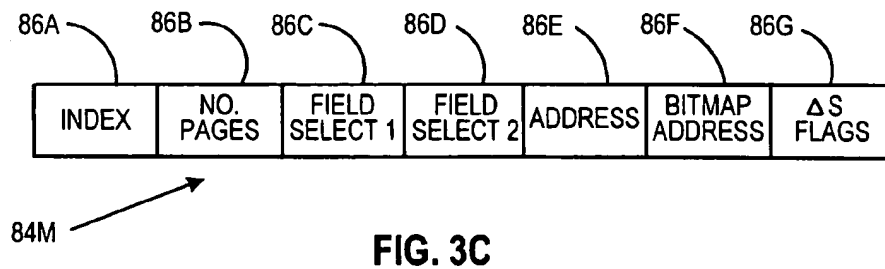
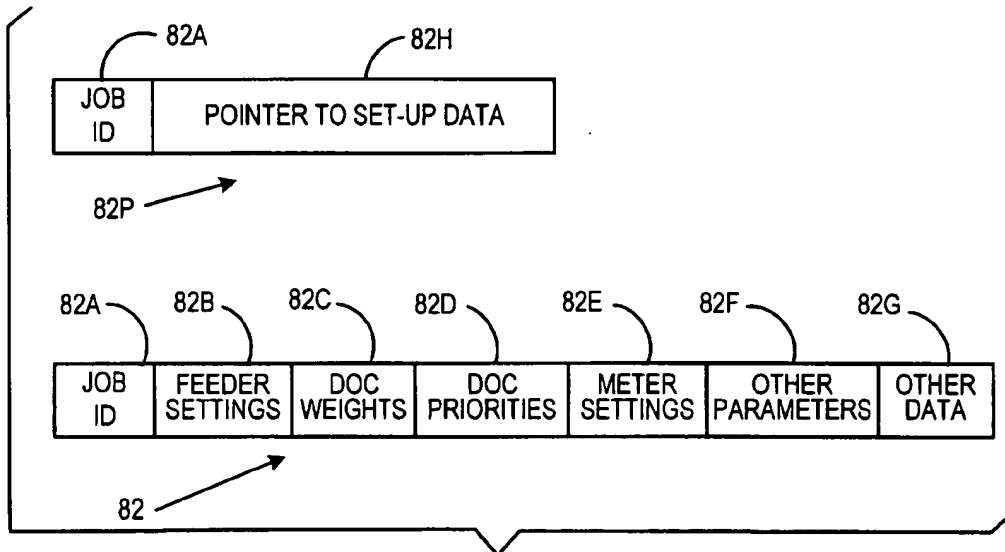
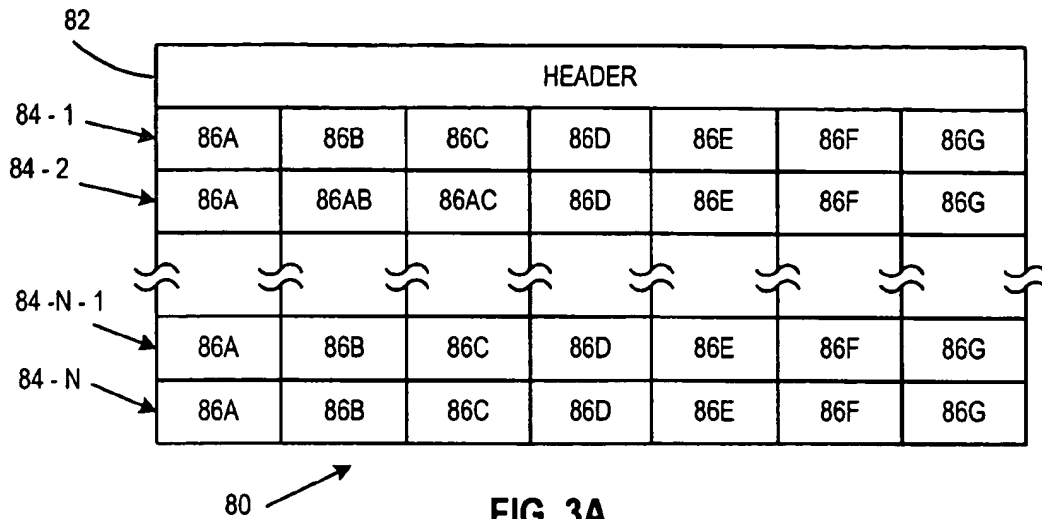


FIG. 4A

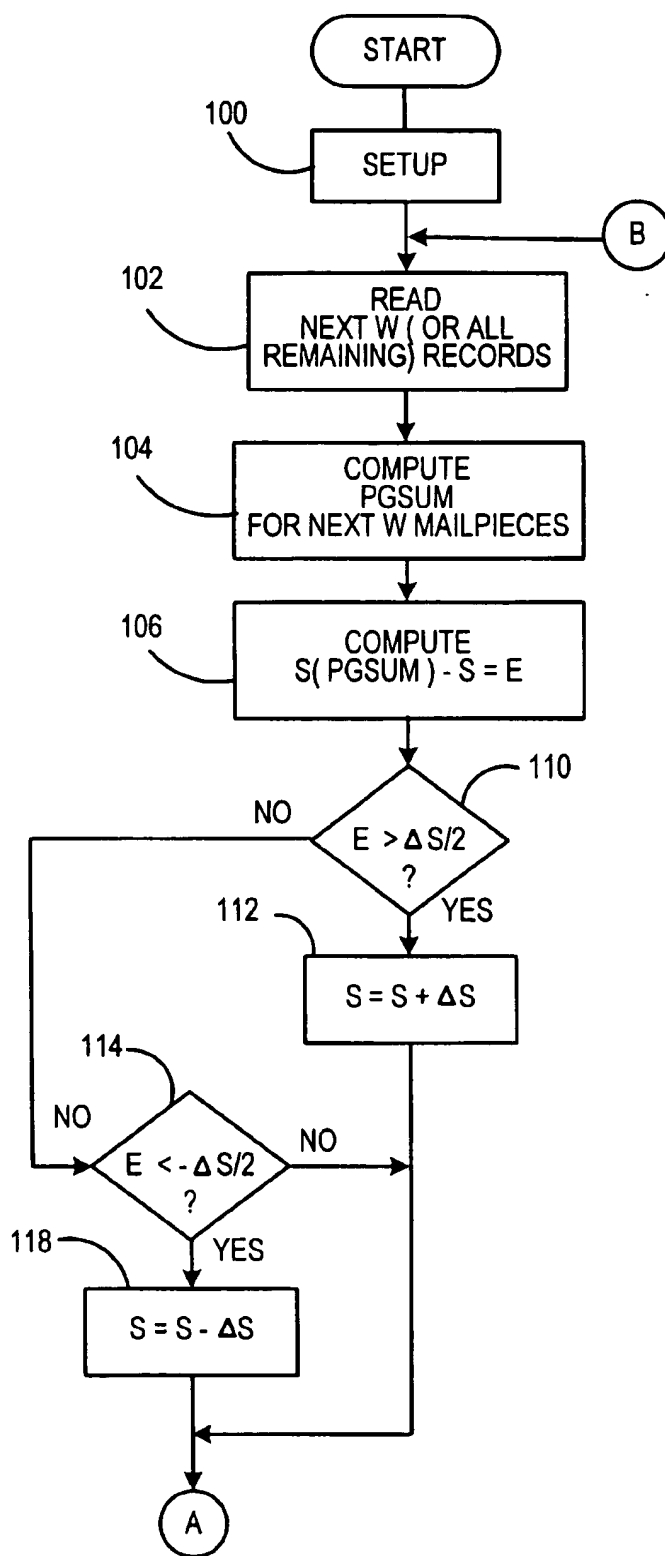
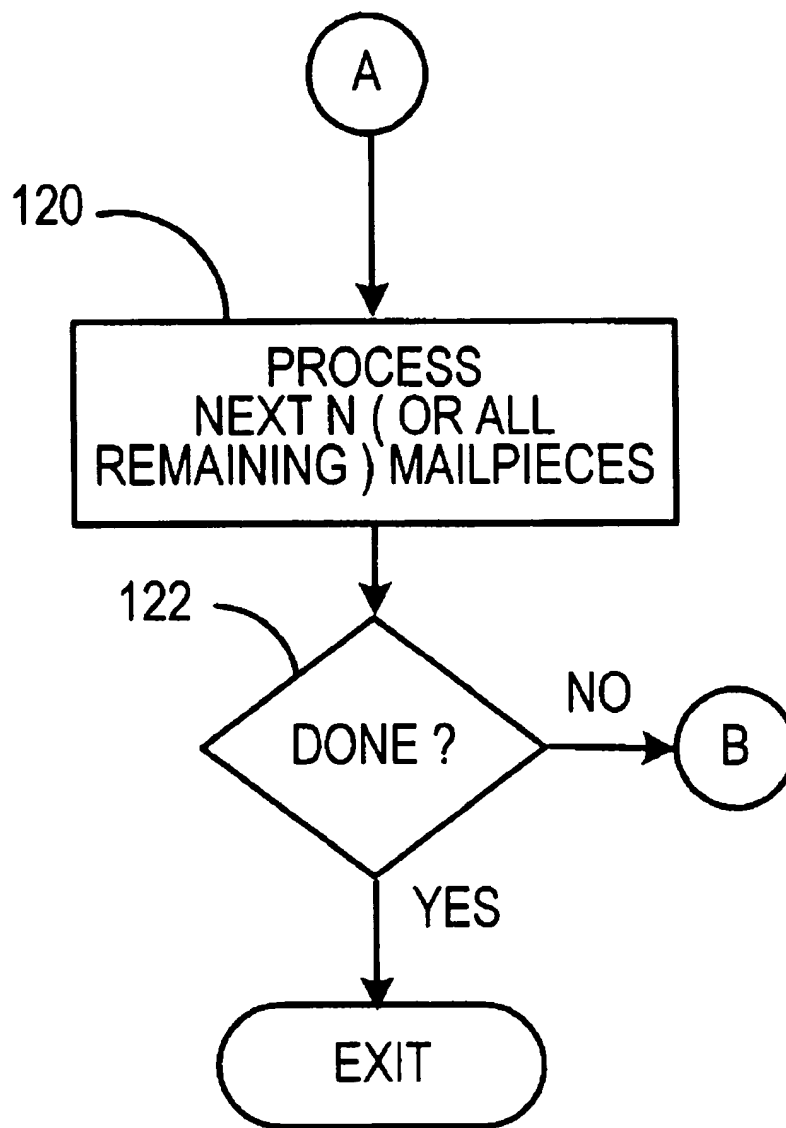


FIG. 4B

PERFORMANCE TUNING OF AN INSERTER SYSTEM BASED UPON A ROLLING AVERAGE OF PAGE COUNTS FOR MAILPIECES TO BE PROCESSED

BACKGROUND OF THE INVENTION

This invention relates to the preparation of large mailings and the like. More particularly it relates to systems and apparatus for the preparation of documents and the assembly of multiple mailpieces including such documents.

The term "mailpieces" as used herein means items intended to be delivered by a postal service or private courier service. Typically preparation of mailpieces includes, but is not limited to, printing or otherwise providing documents including variable information pertaining to addressees of the mailpieces and the assembly of such documents with other elements of the mailpiece. The term "assembly" as used herein means the execution of actions to incorporate the documents into mailpieces. Typically, such actions can include: accumulating documents with other materials such as preprinted inserts, folding and inserting the resulting accumulations into envelopes, printing addresses and other information on the outside of the envelopes, and franking the mailpiece with an appropriate postage amount.

Insert systems for the assembly of mailpieces are well known. A typical inserter system is shown in FIG. 1. Inserter system 10 includes burster/feeder 12 which inputs pre-printed documents in fanfold form, separates the documents and removes and discards sprocket feed strips FS from the edges of the document. Each group of documents for a particular mailpiece includes at least one control document CD. On control documents CD strips FS are marked with code BC which is read by scanner 14 before strips FS are removed. In simpler systems code BC can be a "dash code" of the type known for use in directly controlling inserter systems. In newer, more complex systems code BC can be a conventional bar code which serves as a pointer to a mailpiece record which record contains information for controlling the inserter; as will be more fully described below.

In other known inserter systems, the documents can be in cut sheet form and a cut sheet feeder can be used in place of burster/feeder 12. Control document CD, and any additional associated pages are fed from burster feeder 12 to accumulator 16 where documents for each mailpiece are formed into separate accumulations A and folded.

Accumulation A is then fed to insert stations 20A and 20B where preprinted inserts I are added to form accumulations A1 and A2. Those skilled in the art will of course recognize that the number of such insert stations used will vary from application to application.

Accumulation A2 is then fed to insert station 22 where it is inserted into an envelope and sealed to form mailpiece MP. Mailpiece MP is then fed to address printer 24 which prints address AD on the outside of the envelope. Depending on the size of the print field of printer 24, printer 24 also can be used to print other information such as a variable return address (or other text message) RA, logo L, and postal barcode PBC on the envelope. (Those skilled in the art will recognize that dash codes as described above typically cannot include sufficient information to define even address AD so that systems incorporating dash codes typically use window envelopes to provide addressing information.) System 10 also includes out stacker 30 for diverting mailpieces when an error is detected. As noted above inserter systems wherein said code BC is a barcode which is used as a pointer

to a mailpiece record (i.e. an electronic record associated with a mailpiece to be assembled) are known. By incorporating data for controlling assembly of mailpieces in mailpiece records an essentially unlimited amount of data can be associated with each mailpiece. Thus addresses, return addresses, logos, and postal bar codes can all readily be specified in addition to specification of the number of inserts to be added at each insert feeder, postage amounts, etc. Systems incorporating such mailpiece records are described in commonly assigned U.S. Pat. No. 4,800,505; to: Axelrod et al.; for: Mail Preparation System; issued Jan. 24, 1989, which is hereby incorporated by reference. Embodiments of the system of U.S. Pat. No. 4,800,505 are marketed by the assignee of the present application under the name "Direct Connection", described in *The Direct Connection*, version 1.30.

While systems such as those described above have proven highly successful certain disadvantages remain. In particular the fact that chassis cycles at fixed intervals while documents are delivered at varying intervals means that a potential exists that no documents will be available for a particular cycle. Clearly the possibility of such "dry holes" can be eliminated simply by operating the chassis slowly enough to assure that the maximum number of sheets can be accumulated in one cycle but, equally clearly, operating at that minimal speed will be highly inefficient in the general case where relatively few accumulations with a maximum number of sheets are expected. Conversely, in mailing jobs having a relatively large number of large accumulations, running too fast will cause a large number of dry holes and a higher throughput is achieved by operating the chassis at a slower speed. This problem is exacerbated by the fact that accumulation size will vary with within mailing jobs.

Heretofore efforts to improve the operating efficiency of inserter systems have not addressed this problem in a direct, simple and cost effective manner. Thus, U.S. Pat. Nos. 4,987,547 and 5,083,281; to: Rabindran et al. teach a method for optimizing system speed to minimize time lost to jams and stoppages; while U.S. Pat. No. 5,826,869; to: Nyffenegger teaches a non-standard, buffered, variable speed document feeder which it is believed would substantially add to the cost and complexity of an inserter system. Thus it is an object of the subject invention to provide a simple, cost-effective method for tuning the performance of an inserter system during the run-time of a mailing job.

BRIEF SUMMARY OF THE INVENTION

The above object is achieved and the disadvantages of the prior art are overcome in accordance with the subject invention by means of a method and apparatus for processing mailpieces. An inserter system includes a chassis for assembling the mailpieces, the chassis operating cyclically with successive accumulations advancing at the end of each cycle, and a document feeder for feeding accumulations of documents to the chassis, the accumulations containing varying numbers of documents. The mailpieces each include a control document, the control documents each including data for determining a unique identification code. The method includes the steps of storing a mailing control file, the mailing control file comprising a plurality of mailpiece records, each of the records including a plurality of fields, the fields containing data for controlling assembly of a mailpiece, and each of the records including one of the unique identification codes, whereby each of the records defines preparation of at least one corresponding mailpiece, the records also defining the number of documents comprised in each of the mailpieces; and operating the document

3

feeder at a fixed linear speed, whereby accumulations are available for input to the chassis at varying intervals substantially depending upon the number of documents in corresponding accumulations, so that there is a possibility that no accumulation will be available for particular cycles of the chassis. The chassis is initially operated at a selected speed and which is periodically updated by preferably first determining a measure of the average number of documents to be formed into accumulations for a predetermined number of mail pieces next to be processed and then computing a nominal chassis speed as a function of the measure. A determination between the difference of the nominal chassis speed and the current chassis speed is achieved and if the difference is positive and greater than a first positive value, increasing the chassis speed, and if the difference is negative and less than minus the first value, decreasing the chassis speed. The apparatus then prepares the corresponding mailpieces in accordance with the records.

In accordance with one aspect of the subject invention the chassis speed is increased or decreased by a predetermined fixed amount. In accordance with another aspect of the subject invention the fixed amount is a predetermined function of a system parameter.

In accordance with another aspect of the subject invention the measure is the total number of documents in the predetermined number of mailpieces.

In accordance with another aspect of the subject invention the apparatus further includes a controller and updating of the chassis speed is carried out by the controller during processing of the mailpieces.

In accordance with another aspect of the subject invention the records are generated by a data processing system and the computations for updating of the chassis speed are carried out off-line by the data processing system which then includes an indication whether the chassis speed is to be increased, decreased, or remain unchanged in each of the records.

In accordance with another aspect of the subject invention the predetermined number of mailpieces is determined as a function of the variation in the number of documents in the mailpieces.

In accordance with another aspect of the subject invention the records are generated by a data processing system and the predetermined number of mailpieces is determined off-line by the data processing system which then downloads the predetermined number to the apparatus.

In accordance with another aspect of the subject invention the predetermined number of mailpieces varies during a mailing job as the variation in the number of documents in a mailpiece changes and the nominal chassis speed is computed as a function of the average number of documents in the mailpieces.

Other objects and advantages of the subject invention will be apparent to those skilled in the art from consideration of the attached drawings and the detailed description set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a schematic block diagram of a prior art inserter system;

FIG. 2 shows a schematic block diagram of a system for preparing mailpieces;

FIGS. 3A, 3B and 3C show a mailing control file and a typical mailpiece record and header; and

FIGS. 4A and 4B show a flow diagram of the operation of the system of FIG. 2 to optimize the chassis speed in accordance with the subject invention.

4

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE SUBJECT INVENTION

FIG. 2 shows mail preparation system 40 which includes data processing system 42 and mailpiece assembly system 50.

Data processing system 42 is programmed in a conventional manner to generate documents 46, which include control documents CD and associated documents P; with one control document CD and its associated documents P being associated with each mailpiece, wherein control documents CD are marked with barcode pointers to mailpiece records in the manner described above. In the embodiment shown, system 42 controls printer 44 to print documents 46 directly and documents 46 are transported physically for assembly; however, any convenient method of output and transport, such as electronic output and transmission for remote printing, can be used and is within the contemplation of the subject invention.

Data processing system 42 also generates and outputs mailing control file 80, X is shown in FIG. 3A, which includes header 82 and a plurality of mailpiece records 84-1 through 84-N, in a conventional manner. Mailpiece records 84-1 through 84-N each include a plurality of fields 86A-86G containing data for controlling assembly of the mailpiece.

In a preferred embodiment, the mailing control file also includes data in header 82, shown in FIG. 3B, for defining set-up parameters for the mailing job corresponding to file 80. In FIG. 3B header 82 includes a job ID in field 82A, feeder settings in field 82B, document weights in field 82C, document priorities in field 82D, postage meter settings in field 82E and other set-up parameters, as discussed above, in field (or fields) 82F. In other embodiments of the subject invention field (or fields) 82G can contain additional information relating to the mailing as a whole, such as an account number to be charged to mailing cost centers.

In another preferred embodiment information such as is shown in header 82 can be stored as a separate file, which can be part of a database of job set-up modes. This separate file can then be accessed in any convenient manner. For example, the separate file name can be derived as a function of the job name; e.g. if the job name is mailxxxx.job then the separate record name would be mailxxxx.set. Or, header 82P, also shown in FIG. 3B, which includes pointer 82H to the separate file, can be used in place of header 82.

FIG. 3C shows typical mailing record 84-M. (In general, the content and format of mailpiece records can be freely specified by system users. However, the record must include an index, or identification code, which establishes correspondence between the record and a corresponding mailpiece.) In record 84-M field 86A contains an index, or identification code; field 86B specifies the number of pages in the mailpiece; fields 86C and D specify whether or not corresponding insert stations will add inserts to the mailpiece; field 86E is a printer control field which specifies an address for the corresponding mailpiece; and field 86F is a printer control field. Field 86G relates to control of the chassis speed, as will be described below.

The mailing control file is communicated to mailpiece assembly system 50 through communications link 48, which can utilize any convenient form of communication, such as electronic data communication or the physical transfer of media without departing from the scope of the subject invention.

In the embodiment shown in FIG. 2, mailpiece assembly system 50 includes inserter systems 10A, 10B, and 10C,

which are substantially similar to conventional inserter system 10 described above with reference to FIG. 1, but necessarily must be of the type wherein control documents CD include a barcode pointer to a mailpiece record to carryout the functions of mailpiece assembly. In other embodiments different types of inserter systems having expanded (e.g. more insert modules) or different functions (e.g. matched mail generation or address verification), but still including barcode pointers, can be used without departing from the scope of the subject invention.

Mailpiece assembly system 50 also includes controllers 52A, 52B, and 52C for controlling operation of inserter systems 10A, 10B, and 10C in a manner which will be described more fully below.

Mailpiece assembly system also includes file server 58 which manages mailing control file database 60 which stores mailing control files downloaded from data processing system 42, and which also communicate appropriate mailing control files to controllers 52A, B or C as mailings are assigned to inserter systems, as will be more fully described below.

Mailpiece assembly system also includes manager's workstation 66, which includes display 66D and keyboard 66K through which a site manager can provide operational management input such as accessing and editing database 60 or assigning mailings to various inserter systems.

Communications among workstation 66, file server 58 and controllers 52A, B and C is preferably carried out over a conventional local area network in a manner well understood by those skilled in the art and which need not be discussed further for an understanding of the subject invention.

FIGS. 4A and B show a flow diagram of the operation of a selected controller, hereinafter assumed for purposes of explanation to be controller 52A, to vary the chassis speed to optimize performance (i.e. minimize the number of "dry holes") in accordance with a preferred embodiment of the subject invention. (As noted above the document feeder operates at a fixed speed, but delivers accumulations of documents at varying intervals. Linear speeds in document feeders are in general much higher than in chassis and can be set so that, for the typical mailpiece, the document accumulation will be available for the next chassis slot. By running the document feeder at a constant speed the subject invention takes the fullest advantage of this capability while adjusting chassis speed, as will be described below, to accommodate temporary increases in the average number of sheets in a document. The subject invention is also advantageous in that the document feeder can be more easily tuned for optimal paper handling when it runs at a fixed linear speed.)

At 100 controller 52A, sets up initial parameter values: L, N, S_0 , ΔS , and W. L is the document length and is preferably downloaded from system 42. N is the number of mailpieces which are processed in the intervals between updating of the chassis speed, as will be described further below. Values for N can be selected based on tradeoffs among the desired accuracy (the more often the chassis speed is updated the more accurately it will track the desired profile), the chassis acceleration (it is inefficient to update the nominal chassis speed more rapidly than the chassis can respond), and the computational burden (which of course increases the more frequently the chassis speed is updated). While values for N of about 10 percent of the number of pieces processed per hour are believed generally effective those skilled in the art will be able to select appropriate values of N for particular applications in accordance with the above tradeoffs.

S_0 is an initial chassis speed which can be a fixed value or can be based on estimates of the job characteristics.

ΔS is the size of the speed increment by which the chassis speed can be adjusted every N mailpieces. ΔS can be either a program constant or can be a constant function of a system parameter for various systems, for example a constant fraction of the maximum system speed. Preferably ΔS will be selected to be of moderate size. Too small a value will make it difficult for the system to reach an optimal speed, while too large a value will impose unnecessary stress on the system. Those skilled in the art will be able to select appropriate values of ΔS for particular applications in accordance with the above tradeoffs.

W is the window of mailpieces to be processed which are examined to adjust the chassis speed in accordance with the subject invention. W can be a fixed value or can be based on estimates of the job characteristics. Values of W are substantially based on the amount of variation in the number of documents comprised in each mailpiece. If the number of documents is substantially constant for long runs of mailpieces, W can be large with respect to N thereby reducing the rate of change of the chassis speed. Conversely, if the number of documents changes rapidly W can be selected smaller to more closely follow the mail job. While values for W of about 500-1000 mailpieces are believed generally effective, those skilled in the art will be able to select appropriate values of N for particular applications in accordance with the above tradeoffs.

In other embodiments of the subject invention, where parameter values such as L, S_0 and W are based on estimates of the job characteristics these estimates can be carried out off-line by data processing system 42 and down loaded to system 50. In preferred embodiments this downloading is carried out in accordance with the method of commonly assigned, co-pending U.S. patent application Ser. No. 09/411,099, Title: SYSTEM AND APPARATUS FOR PREPARATION OF MAILPIECES AND METHOD FOR FILEBASED SETUP OF SUCH APPARATUS; filed Oct. 4, 1999, which is hereby incorporated by reference.

At 102 controller 52A reads the next W mailpiece records, and at 104 computes PGSUM, the total number of documents included in the next W mailpieces.

At 106 the controller computes the difference E between a nominal value, S(PGSUM), based on the average number of documents in the next W mailpieces, PGSUM, and the current chassis speed S. (To a good approximation the document feeder linear speed divided by the document length divided by the average number of documents per mailpiece, i.e. per accumulation, equals the average number of mailpieces per unit time and the chassis speed is adjusted to give a corresponding cyclic rate.)

It should be noted that in the embodiment shown W is constant so that PGSUM is directly proportional to the average number of mailpieces and the average need not be computed explicitly. In other embodiments where W can vary the actual average is computed and used to determine the nominal speed.

At 110 controller 52A determines if E is greater than a first value, preferably $\Delta S/2$. If so, then at 112 the current speed S is increased by an increment ΔS ; and if not then at 114 the controller determines if E is less than $-\Delta S/2$, and if so, speed S is decreased by ΔS .

In any event, whether or not the current speed is adjusted, controller 52A goes to 120 and processes the next N mailpieces. Details of such processing are well known and are described for example in the above described commonly

owned references, and need not be discussed further here for an understanding of the subject invention.

At 122 controller 52A determines if the mail job is done and, if not, returns to 102, and otherwise exits.

In another embodiment of the subject invention, the above calculations can be carried out off-line by data processing system 42 if that system has sufficient information such as document feeder linear speed, document lengths, etc. Returning to FIGS. 3A and C, in such embodiments an additional field 86G can be added to each of records 84M by system 42 to flag to controller 52A whether or not an increment ΔS is to be added or subtracted to the current chassis speed S or whether S is to remain unchanged when the records are accessed to process each mailpiece.

As discussed above, values for W can be varied if the variation in the distribution of documents in mailpieces requires. It should be noted that W can also be varied within a particular job by down loading plural successive values during set-up.

The embodiments described above and illustrated in the attached drawings have been given by way of example and illustration only. From the teaching of the present application those skilled in the art will readily recognize numerous other embodiments in accordance with the subject invention. Accordingly, limitations on the subject invention are to be found only in the claims set forth below.

What is claimed is:

1. A method for controlling apparatus for assembly of mailpieces, the apparatus including an inserter system comprising a chassis for assembling the mailpieces, the chassis operating cyclically with successive accumulations advancing at the end of each cycle, and a document feeder for feeding accumulations of documents to the chassis, the accumulations containing varying numbers of documents, the mailpieces each including a control document, the control documents each including data for determining a unique identification code, the method comprising the steps of:

- a) storing a mailing control file, the mailing control file comprising a plurality of mailpiece records, each of the records including a plurality of fields, the fields containing data for controlling assembly of a mailpiece, and each of the records including one of the unique identification codes, whereby each of the records defines preparation of at least one corresponding mailpiece, the records also defining the number of documents comprised in each of the mailpieces;
- b) operating the document feeder at a fixed linear speed, whereby accumulations are available for input to the chassis at varying intervals substantially depending upon the number of documents in corresponding accumulations, so that there is a possibility that no accumulation will be available for particular cycles of the chassis;
- c) initially operating the chassis at a selected speed and periodically updating the chassis speed by;
 - c1) determining a measure of the average number of documents to be formed into accumulations for a predetermined number of mail pieces next to be processed;
 - c2) computing a nominal chassis speed as a function of the measure;
 - c3) determining the difference between the nominal chassis speed and the current chassis speed;
 - c4) if the difference is greater than a first positive value, increasing the chassis speed; and
 - c5) if the difference is less than a first negative value, decreasing the chassis speed; and

d) controlling the assembling means to prepare the corresponding mailpieces in accordance with the records.

2. A method as described in claim 1 wherein the chassis speed is increased or decreased by a predetermined fixed amount.

3. A method as described in claim 2 wherein the fixed amount is a predetermined function of a system parameter.

4. A method as described in claim 1 wherein the measure is the total number of documents in the predetermined number of mailpieces.

5. A method as described in claim 1 wherein the apparatus further includes a controller and updating of the chassis speed is carried out by the controller during processing of the mailpieces.

6. A method as described in claim 1 wherein the records are generated by a data processing system and the computations for updating of the chassis speed are carried out off-line by the data processing system which then includes an indication whether the chassis speed is to be increased, decreased, or remain unchanged in each of the records.

7. A method as described in claim 1 wherein the predetermined number of mailpieces is determined as a function of the variation in the number of documents in the mailpieces.

8. A method as described in claim 7 wherein the records are generated by a data processing system and the predetermined number of mailpieces is determined off-line by the data processing system which then downloads the predetermined number to the apparatus.

9. A method as described in claim 1 wherein the predetermined number of mailpieces varies during a mailing job as the variation in the number of documents in a mailpiece changes and the nominal chassis speed is computed as a function of the average number of documents in the mailpieces.

10. Apparatus for assembling mailpieces, the mailpieces each including a control document, the control documents each including data for determining a unique identification code, the apparatus comprising:

- a) storing means for storing a mailing control file, the mailing control file comprising a plurality of mailpiece records, each of the records including a plurality of fields, the fields containing data for controlling assembly of a mailpiece, and each of the records including one of the unique identification codes, whereby each of the records defines preparation of at least one corresponding mailpiece, the records also defining the number of documents comprised in each of the mailpieces;
- b) means for assembling the mailpieces, the assembling means including an inserter system comprising a chassis for assembling the mailpieces, the chassis operating cyclically with successive accumulations advancing at the end of each cycle, and a document feeder for feeding accumulations of documents to the chassis, the accumulations containing varying numbers of documents;
- c) a controller for:
 - c1) initially operating the chassis at a selected speed and updating the chassis speed in accordance with the records by;
 - 1.1) determining a measure of the average number of documents to be formed into accumulations for a predetermined number of mail pieces next to be processed by;
 - c1.2) computing a nominal chassis speed as a function of the measure;
 - c1.3) determining the difference between the nominal chassis speed and the current chassis speed;

- c1.4) if the difference is than a first positive value, increasing the chassis speed; and
 c1.5) if the difference is less than a first negative value, decreasing the chassis speed; and
 c2) controlling the assembling means to prepare the corresponding mailpieces in accordance with the records.
11. Apparatus as described in claim 10 wherein the chassis speed is increased or decreased by a predetermined fixed amount.
12. Apparatus as described in claim 11 wherein the fixed amount is a predetermined function of a system parameter.
13. Apparatus as described in claim 10 wherein the predetermined number of mailpieces is determined as a function of the variation in the number of documents in the mailpieces.
14. Apparatus as described in claim 10 wherein the records are generated by a data processing system and the predetermined number of mailpieces is determined off-line by the data processing system which then downloads the predetermined number to the apparatus.
15. Apparatus as described in claim 10 wherein the predetermined number of mailpieces varies during a mailing job as the variation in the number of documents in a mailpiece changes and the nominal chassis speed is computed as a function of the average number of documents in the mailpieces.
16. Apparatus for assembling mailpieces, the mailpieces each including a control document, the control documents each including data for determining a unique identification code, the apparatus comprising:
- a) storing means for storing a mailing control file, the mailing control file comprising a plurality of mailpiece records, each of the records including a plurality of fields, the fields containing data for controlling assembly of a mailpiece, and each of the records including one of the unique identification codes, whereby each of the records defines preparation of at least one corresponding mailpiece, the records also defining whether a chassis speed is to be increased, decreased or remain unchanged;
 - b) means for assembling the mailpieces, the assembling means including an inserter system comprising a chassis for assembling the mailpieces, the chassis operating cyclically with successive accumulations advancing at the end of each cycle, and a document feeder for feeding accumulations of documents to the chassis, the accumulations containing varying numbers of documents;
 - c) a controller for:
 - c1) initially operating the chassis at a selected speed and updating the chassis speed in accordance with the records; and
 - c2) controlling the assembling means to prepare the corresponding mailpieces in accordance with the records.

17. Apparatus as described in claim 16 wherein the chassis speed is increased or decreased by a predetermined fixed amount.

18. Apparatus as described in claim 17 wherein the fixed amount is a predetermined function of a system parameter.

19. Apparatus as described in claim 16 wherein the records are generated by a data processing system and the predetermined number of mailpieces is determined off-line by the data processing system which then downloads the predetermined number to the apparatus.

20. A system for assembling mailpieces, the mailpieces each including a control document, the control documents each including data for determining a unique identification code, the apparatus comprising:

- a) a data processing system for generating a mailing control file comprising a plurality of mailpiece records, each of the records including a plurality of fields, the fields containing data for controlling assembly of a mailpiece, and each of the records including one of the unique identification codes, whereby each of the records defines preparation of at least one corresponding mailpiece, the records also defining the number of documents comprised in each of the mailpieces;
- b) storing means for storing said mailing control file,
- c) means for assembling the mailpieces, the assembling means including an inserter system comprising a chassis for assembling the mailpieces, the chassis operating cyclically with successive accumulations advancing at the end of each cycle, and a document feeder for feeding accumulations of documents to the chassis, the accumulations containing varying numbers of documents;
- d) a controller for:
 - d1) initially operating the chassis at a selected speed and updating the chassis speed in accordance with the records by:
 - d1.1) determining a measure of the average number of documents to be formed into accumulations for a predetermined number of mail pieces next to be processed by;
 - d1.2) computing a nominal chassis speed as a function of the measure;
 - d1.3) determining the difference between the nominal chassis speed and the current chassis speed;
 - d1.4) if the difference is than a first positive value, increasing the chassis speed; and
 - d1.5) if the difference is less than a first negative value, decreasing the chassis speed; and
 - d2) controlling the assembling means to prepare the corresponding mailpieces in accordance with the records.

* * * * *



US006343327B2

(12) **United States Patent**
Daniels, Jr. et al.

(10) Patent No.: **US 6,343,327 B2**
 (45) Date of Patent: ***Jan. 29, 2002**

(54) **SYSTEM AND METHOD FOR ELECTRONIC AND PHYSICAL MASS MAILING**

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(57) ABSTRACT

A printstream processor separates documents, e.g. in a printstream or batch, into a physical delivery printstream and an electronic delivery printstream based on delivery preferences stored in a database. The documents in the physical delivery printstream are printed and combined with physical inserts for physical delivery, e.g. by the U.S. Postal Server. The documents in the electronic delivery printstream are combined with electronic inserts for electronic delivery, for example, via electronic mail, facsimile, pager, or to a server on World Wide Web.

30 Claims, 6 Drawing Sheets

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(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/968,649**

(22) Filed: **Nov. 12, 1997**

(51) Int. Cl.⁷ **G06F 13/14**

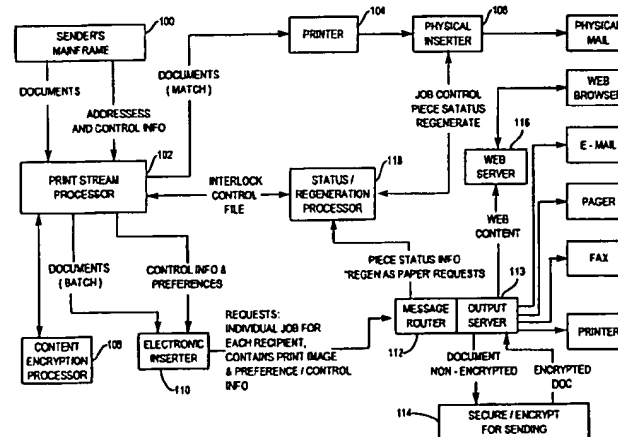
(52) U.S. Cl. **709/239; 345/335**

(58) Field of Search 395/200.49; 345/335; 358/402, 4.3; 709/238, 239, 240; 382/137

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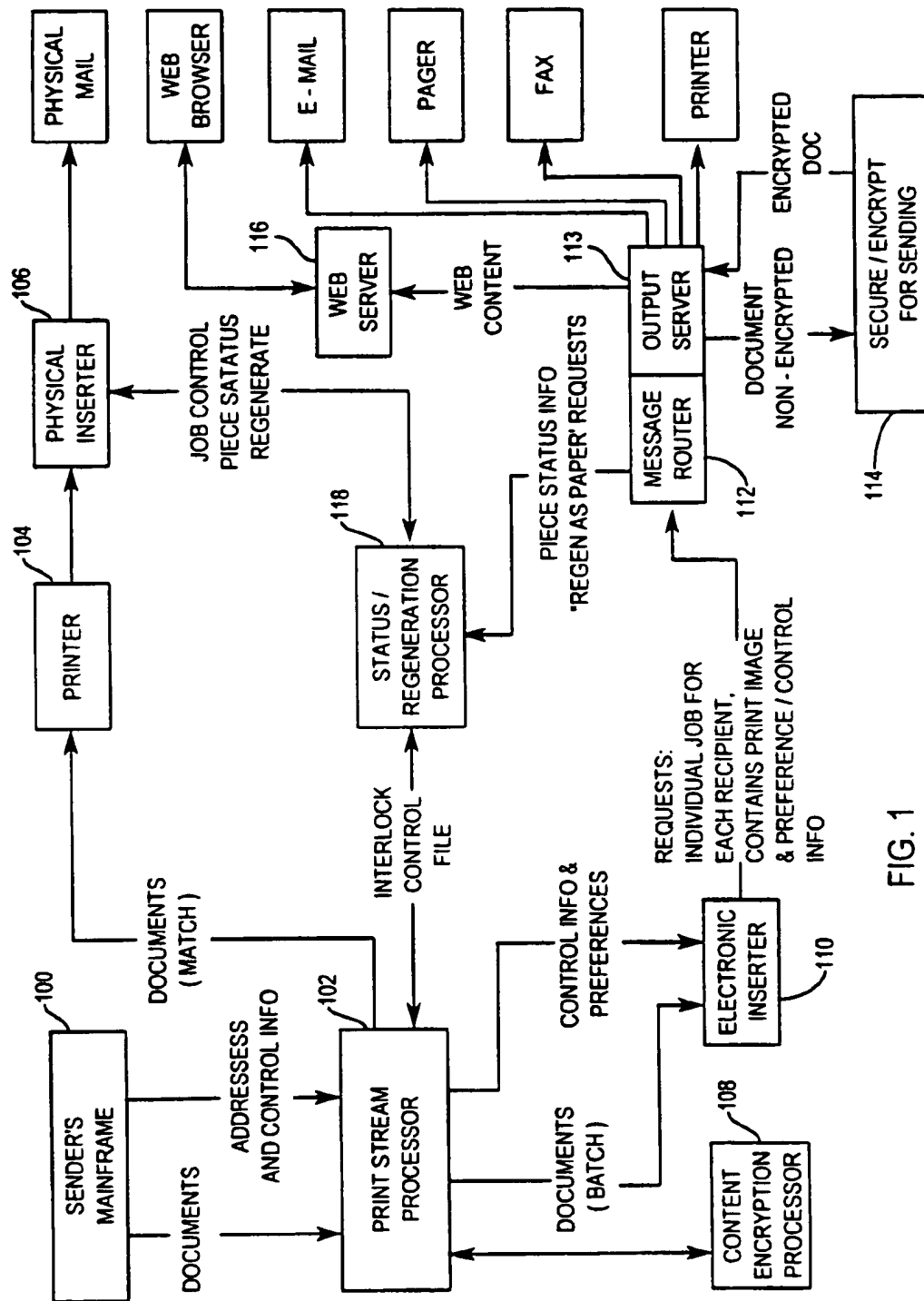
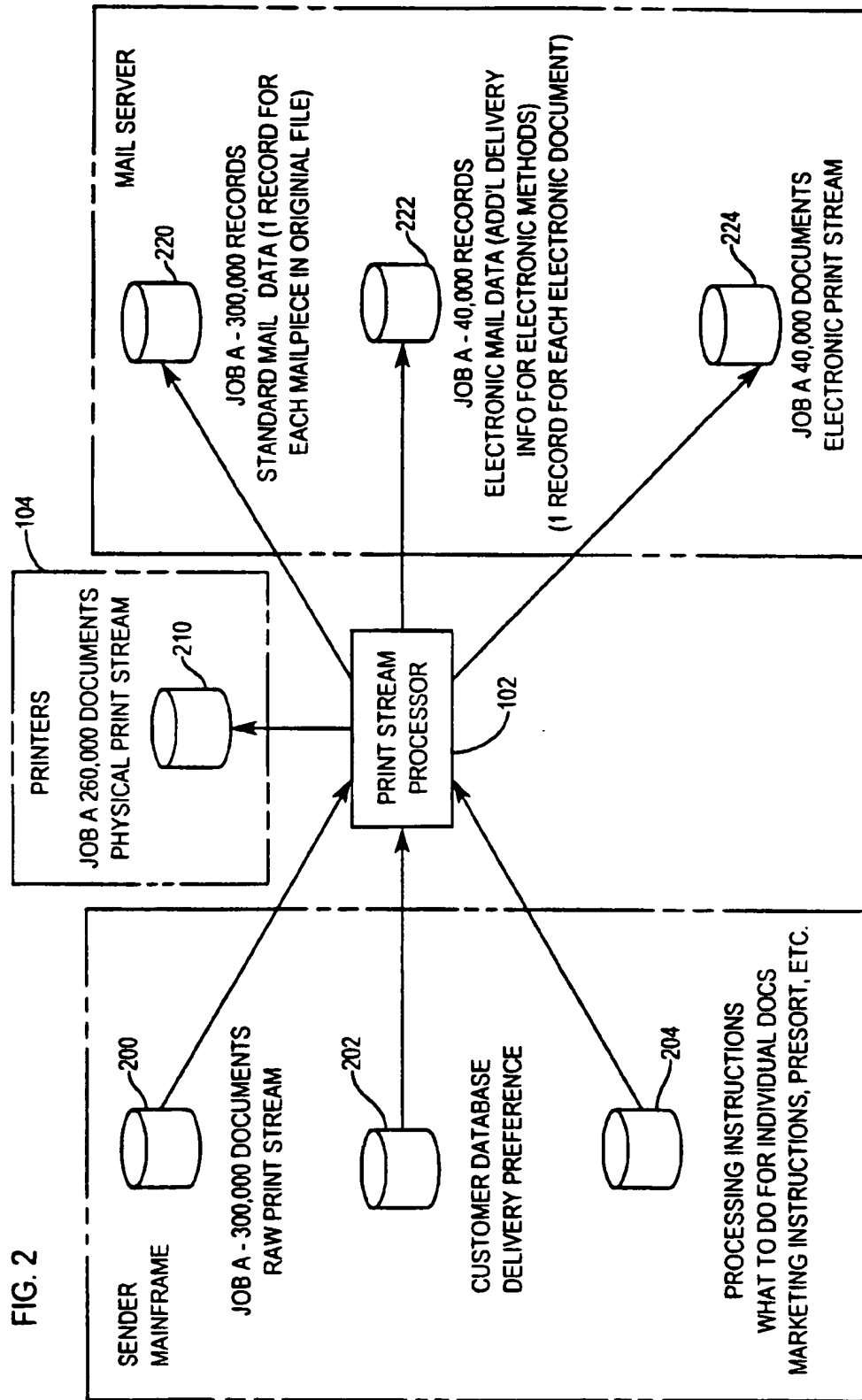
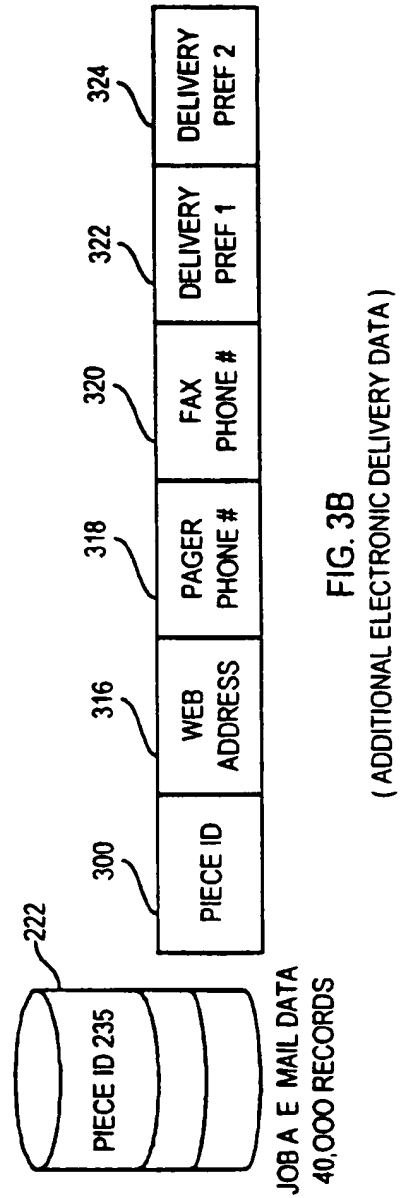
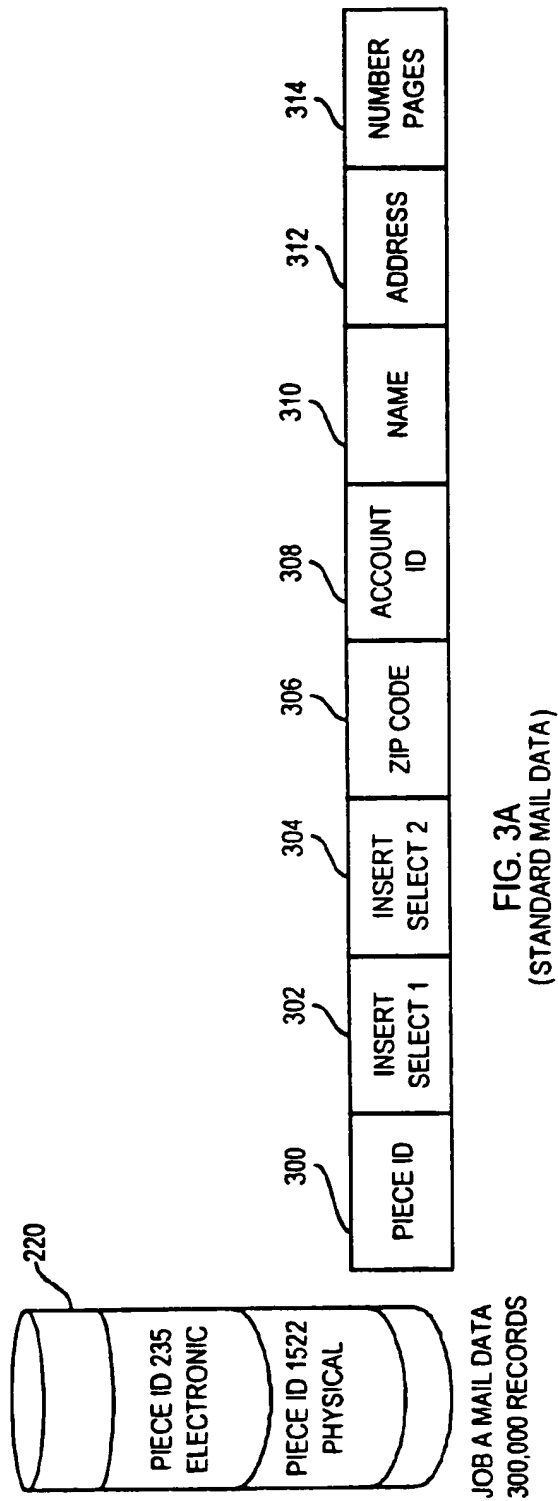
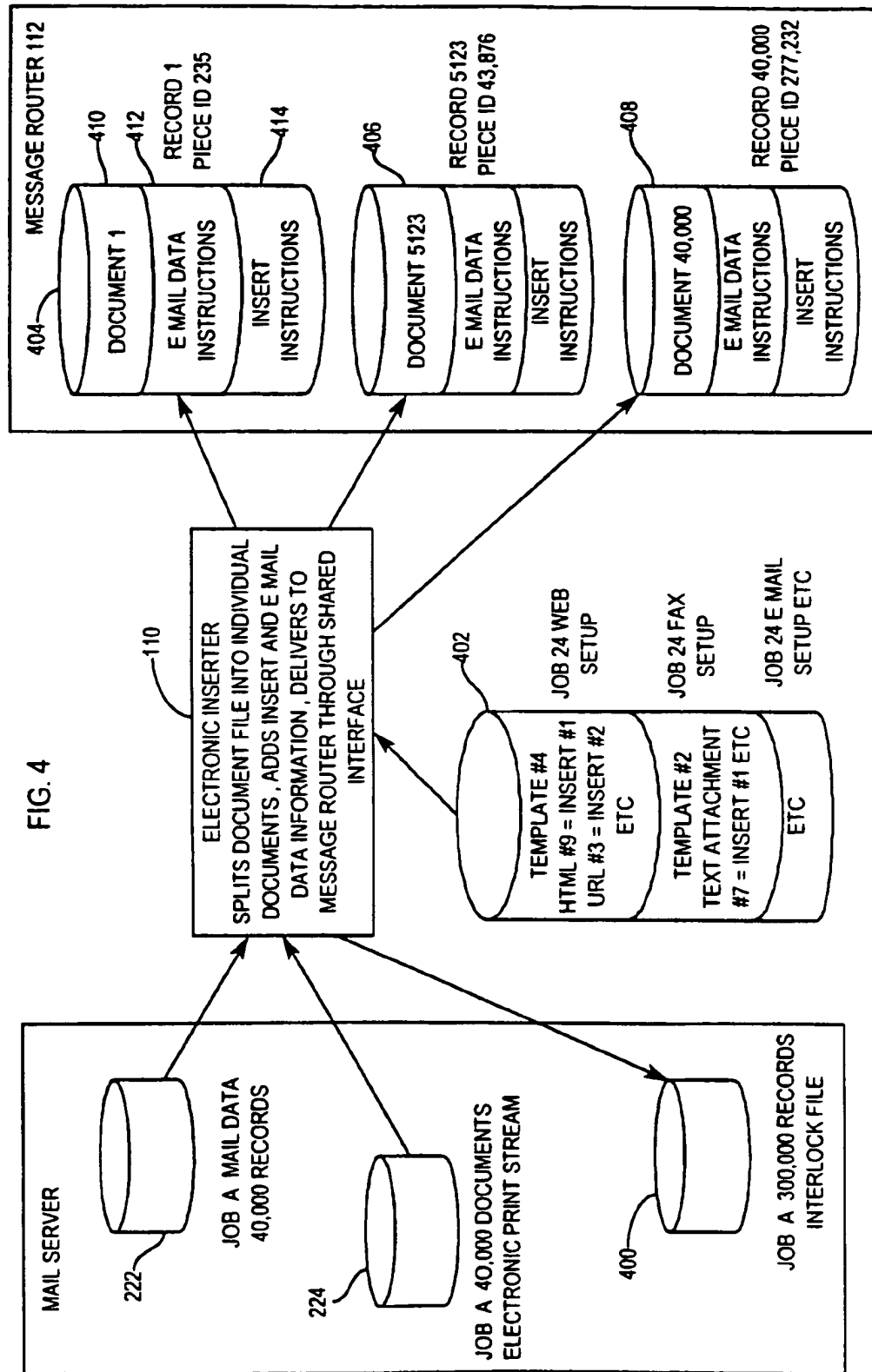
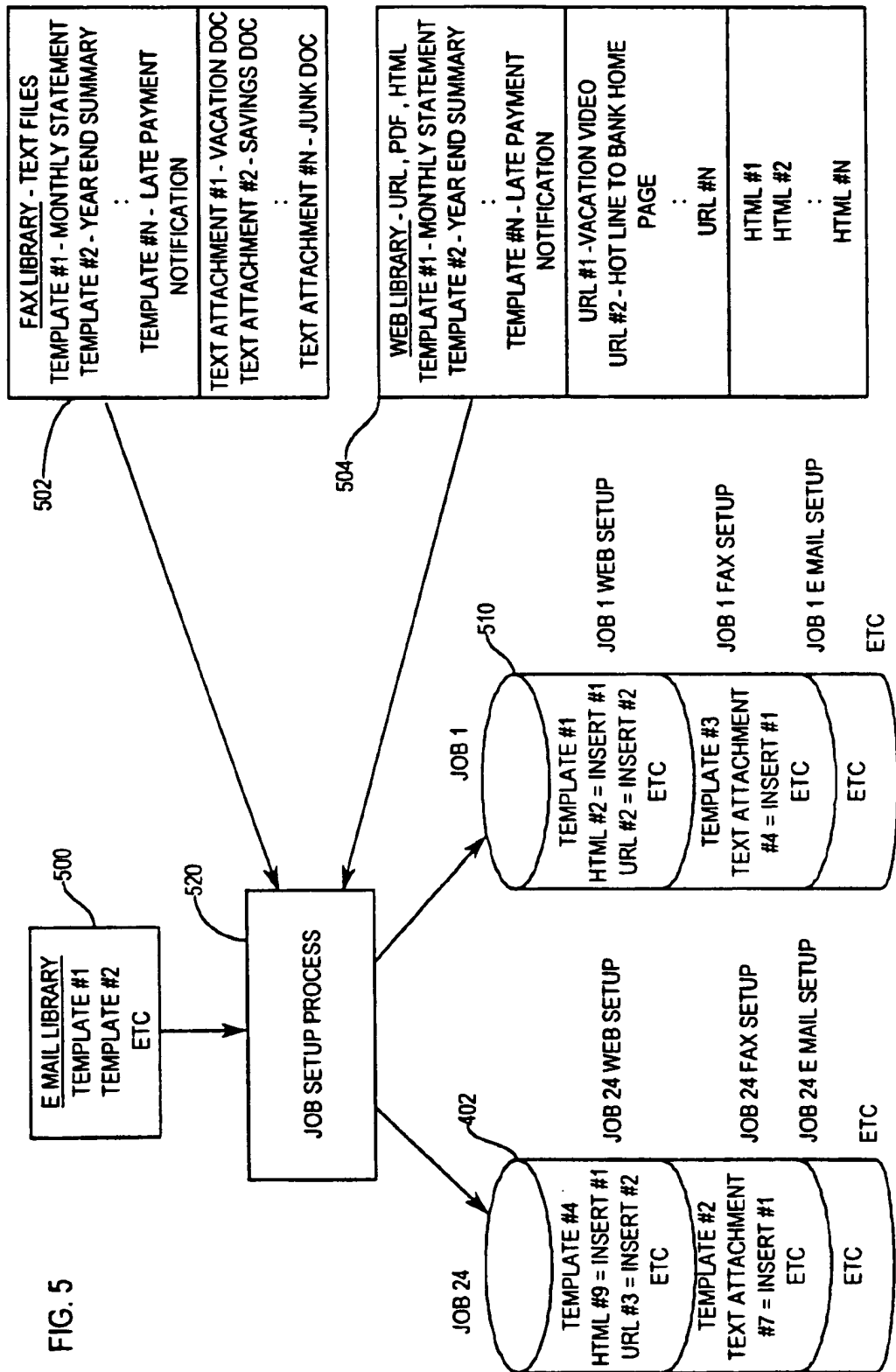


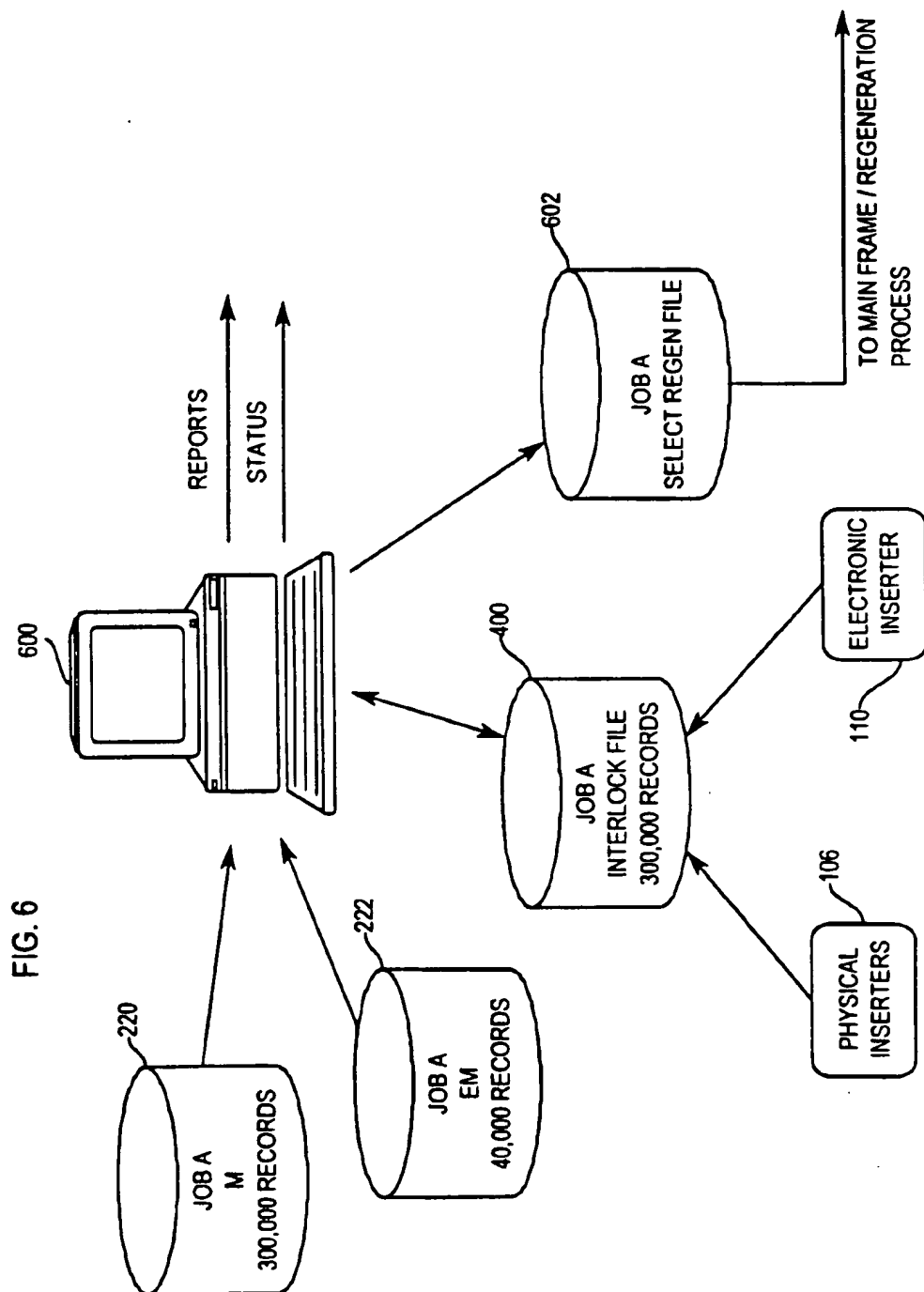
FIG. 1











SYSTEM AND METHOD FOR ELECTRONIC AND PHYSICAL MASS MAILING

TECHNICAL FIELD

The present invention relates to mass mail delivery mechanisms and, more particularly, to combined electronic and physical delivery mechanisms.

BACKGROUND ART

Many businesses currently send out mass mailings to their customers or prospective customers. For example, a utility, e.g. electric company, may send out hundreds of thousands of bills to its customers every month. As another example, a company may wish to send targeted marketing material, such as a sales letter, to prospective customers on a mailing list. In either example, a company may augment the bill or basic sales letter with additional material called "inserts," for example, a brochure or a glossy advertisement.

There currently exist computer systems, software, and specialized peripherals for producing mass mailings for physical delivery, e.g. through the U.S. Postal Service or by courier. With the advent of new forms of electronic mail delivery, however, it is becoming more desirable to augment existing mass mailing capability with electronic delivery mechanisms, such as by electronic mail (email), facsimile, pager, or publication to a page on the World Wide Web. However, there are many reasons why it is difficult to upgrade or replace these computers systems for electronic mail delivery.

Often these computer systems are called "legacy" computer systems because they are relatively old computer systems handed down from previous generations of company management. These legacy computer systems, however, are still effective and often control processing vital to the company's business, e.g. bill production. Such legacy systems for mass mailing document production typically run on a mainframe computer and are complex and expensive. Accordingly, companies are reluctant to modify, upgrade, or replace these critical document generation applications.

Another reason why upgrading a business application is difficult is that the business application is written by a third-party developer with exclusive access to the source code and unwilling or unable to upgrade the application. For example, the business application may have been written by a company that has gone out of business or discontinued support for that application.

Even if a company has access to the source code of its mass mailing application, the company may not have the resources in terms of time or programming staff to make the necessary modifications for electronic mail delivery.

As an additional complication, electronic mail delivery may take a variety of forms, e.g. email, facsimile, pager. Each electronic delivery mechanism imposes restrictions on the nature of inserts added to the mailing. For example, an alphanumeric pager can only receive a small number of characters.

DISCLOSURE OF THE INVENTION

There exists a need for adding capabilities of electronic mail delivery to existing mass mailing systems. There is also a need for handling inserts in a manner appropriate to the delivery mechanism.

These and other needs are met by an electronic delivery system and method in which a printstream processor separates documents into a physical delivery printstream and an

electronic delivery printstream based on delivery preferences stored in a database. A printer prints the physical delivery printstream to create printed documents. A physical inserter generates physical mail pieces including one of the printed documents and, for at least some of the physical mail pieces, respective physical inserts. An electronic inserter splits the electronic delivery printstream into electronic documents and generates electronic mail pieces. Each of the electronic mail pieces includes one of the electronic documents and, for at least some of the electronic mail pieces, an electronic insert. The electronic insert may be a link to a World Wide Web site, a text attachment, a document, or an electronic copy of a physical insert.

A message router delivers the electronic mail pieces via an electronic delivery mechanism specified in the delivery preferences, e.g. to a web server, an electronic mail address, a pager, a facsimile machine, and a printer. Preferably, the message router is configured to deliver an electronic mail piece by one electronic delivery mechanism and a notification message by another electronic delivery mechanism. The system may include a regeneration processor for causing a physical mail piece to be generated, corresponding to an electronic mail piece that has not been delivered.

Another aspect of the invention is a method of mass mailing in which a first batch of print images is received. The method includes determining whether or not each print image is to be delivered physically, in which case the print image is stored in a second batch, or electronically, in which case the print image is stored in a third batch. Preferably, first records indicating a physical delivery address is stored for all the print images of the first batch, and second records indicating an electronic delivery address is stored for all the print images of the third batch.

The software aspects encompass media or carrier waves bearing sequences of computer executable instructions for performing the steps of the invention. A computer readable medium, as used herein, may be any medium that can bear instructions or code for performing a sequence of steps in a machine readable form, such as a floppy disk, flexible disk, CD-ROM, magnetic tape, any other magnetic medium, a hard-ROM, an other optical medium, a RAM, ROM, PROM, EPROM, FLASH-EPROM, and any other memory chip or cartridge. A carrier wave signal is any type of signal that may carry digital information representative of the instructions or code for performing a sequence of steps. Such a carrier wave may be received via a network, over a modem, or as a radio-frequency or infrared signal, or any other type of signal which a computer may receive and decode.

Additional objects, advantages, and novel features of the present invention will be set forth in part in the detailed description which follows, and in part will become apparent upon examination or may be learned by practice of the invention. The objects and advantages of the invention may be realized and obtained by means of the instrumentality's and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

The present invention is illustrated by way of example and not by limitation, in the figures of the accompanying drawings, wherein elements having the same reference numeral designations represent like elements throughout and wherein:

FIG. 1 is a diagram of the printstream delivery architecture according to an embodiment.

FIG. 2 is an input/output diagram of a printstream processor according to an embodiment.

FIGS. 3A and 3B are diagrams showing the format of records of the mail run datafile and of the electronic mail run datafile according to an embodiment.

FIG. 4 is an input/output diagram of an electronic inserter according to an embodiment.

FIG. 5 is an input/output diagram of a job setup process according to an embodiment.

FIG. 6 is an input/output diagram of a regeneration processor according to an embodiment.

BEST MODE FOR CARRYING OUT THE INVENTION

A system and method of physical and electronic printstream delivery are described. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, that the present invention may be practiced without these specific details. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring the present invention.

Printstream Delivery Architecture Overview

FIG. 1 depicts a printstream delivery architecture according to an embodiment of the present invention. A user at a sender's mainframe 100 submits to printstream processor 102 documents in a printstream, addressing information in the form of delivery preferences stored in a database, and control information specifying, e.g., what inserts are to be included with each document in the printstream.

A printstream may be a batch of documents or print images of documents produced by a third-party or legacy business application. For example, a billing system may produce a batch of bills that are to be printed and sent to each customer. By employing a printstream processor 102 as a post processor with supplemental addressing and control information outside of the business application that produced the printstream, the functionality of the business application can be extended without change to the business application.

Printstream processor 102 splits the submitted printstream into one of two printstreams based on the addressing information in the delivery preferences. One printstream is a physical delivery printstream, in which the documents are to be delivered, as specified in the addressing information, to a physical address via a physical delivery mechanism, for example, the U.S. Postal Service or a courier service. The other printstream is an electronic delivery printstream, in which the documents are to be delivered via an electronic delivery mechanism, e.g. the electronic mail or facsimile, as specified in the delivery preferences. Printstream processor 102 may encrypt the documents with a content encryption processor 108.

The physical delivery printstream is sent from the printstream processor 102 to a printer 104 where the documents in the physical delivery printstream are printed on a tangible medium such as paper. The printed documents are sent to a physical inserter 106 where they are processed into physical mail pieces. For example, a physical mail piece may contain a properly addressed envelope with the proper postage and stuffed with the printed document. In addition, the envelope may include additional printed matter, called physical inserts, selected according to criteria in the control information. The physical mail pieces are then ready for delivery by traditional means, e.g. through the U.S. Postal Service.

The electronic delivery printstream is sent to an electronic inserter 110, which separates out the individual documents in the electronic delivery printstream and combines the document with the appropriate electronic insert based on the control information to produce an electronic mail piece. Moreover, the nature of the electronic insert is tailored to the particular electronic delivery mechanism specified in the addressing information. For example, an insert for a facsimile delivery is another document faxed along with the individual document. As another example, delivery to a World Wide Web site involves an insert which is a link specifying the URL (Uniform Resource Location) of another page on the World Wide Web.

The separate electronic mail pieces are sent to message router 112 for delivery to the delivery mechanism specified in the addressing information, e.g. to a web server 116, electronic mail address, pager, facsimile machine, or a networked printer. The message router 112 is configured to send a separate notification via another delivery mechanism. For example, message router 112 may deliver an electronic mail piece to a web server 116 and send the recipient a generic fax that informs the recipient of the delivery to the web server 116. In addition, message router 112 may encrypt or otherwise provide for security of the outgoing electronic mail piece via security module 114.

If the electronic mail piece is not delivered after a certain length of time, the message router 112 generates and sends a "failed to process" or "failed to deliver" message to status/regeneration processor 118, which (depending on the users configured system, which system is configurable) may cause a physical version of the undelivered electronic mail piece to be produced by printer 104 and physical inserter 106 and delivery by physical means.

Printstream Processor

Exemplary input and output of printstream processor 102 is illustrated in FIG. 2. A user at a mainframe may submit to the printstream processor 102 a job "A" comprising 300,000 documents in a raw printstream 200. This raw printstream 200 may be the output of a legacy application executing on the mainframe. The printstream processor 102 may be an application executing on the same mainframe or an application executing on another computer, e.g. a workstation or PC, networked to the mainframe.

The printstream processor 102 utilizes a customer database 202 of delivery preferences that indicate how each document for each recipient is to be delivered, e.g. physically, by fax, etc. Control information 204 is also input to printstream processor 102 to specify processing instructions, for example, which inserts are to be included and whether to presort the documents.

Printstream processor 102 separates the raw printstream into two printstreams, one for physical delivery and another for electronic delivery. In the example depicted in FIG. 2, printstream processor 102 separates raw printstream 200 into a physical delivery printstream 210 comprising 260,000 documents. Physical delivery printstream 210 is sent to printer 104 for the next step in the physical delivery process. The other printstream is electronic delivery printstream 224 comprising the remaining 40,000 documents of the raw printstream 200. Electronic delivery printstream 224 is sent to electronic inserter 110 for the next step in the electronic delivery process.

Printstream processor 102 also produces two datafiles, mail run datafile 220 and electronic mail run datafile 222. Mail run datafile 220 contains one record for every docu-

ment in the original raw printstream 200. The contents of each record in mail run datafile 220 is illustrated in FIG. 3. Each mail run datafile 220 record includes a piece identifier 300, which may specify the sort order of the documents. In addition, each record may contain one or two insert selections 302 and 304, which specify the insert(s) that may be included with the respective document. For example, an insert selection 302 for a physical mail piece may be a brochure describing a ski resort in Vermont. The mail run datafile 220 record also includes such physical delivery information as a ZIP code 306, an account identifier 308, a name 310, an address 312, and a number of pages 314 for the document. The mail run datafile 220 is used by the printer 104 and physical inserter 106 for generating physical mail pieces with the selected inserts and the proper physical mail address.

If a mail piece is to be delivered by electronic means, as specified in the customer database 202 of delivery preferences, the printstream processor 200 creates a record in the electronic mail run datafile 222 in parallel to the mail run datafile 220. Thus, the tenth record in electronic mail run datafile 222 corresponds to the tenth electronic mail piece in electronic delivery printstream 224. Each of the electronic mail run datafile 222 records contain a piece identifier 300, in order to match up with the corresponding record in the mail run datafile 220. The records also contain electronic delivery information derived from the customer database 202 such as a Web address or URL 316, a pager telephone number 318, and a fax number 320. In addition, the records contain delivery and notification preferences 322 and 324, to specify which delivery option is to be given priority. As described in more detail hereinafter, the electronic delivery information in records of the electronic mail run datafile 222 is attached to the respective electronic mail piece by electronic inserter 110 for delivery by message router 112.

Although mail run datafile 220 contains information mainly for physical delivery, all documents to be delivered electronically have a corresponding entry in mail run datafile 220 in case the mail piece has to be delivered physically. Electronic mail pieces may require physical delivery, via regeneration processor 118 described in more detail hereinafter, if the electronic delivery mechanisms do not successfully deliver the electronic mail piece. For example, electronic mail piece 235 in FIG. 3 has a record in both mail run datafile 220 and electronic mail run datafile 222.

Electronic Inserter

As depicted in FIG. 4, electronic inserter 110 splits the electronic delivery printstream 224 into individual electronic mail pieces and packages them with an insert appropriate for the electronic delivery mechanism specified for the electronic mail pieces. Electronic inserter 110 is preferably a computer software application, which may be executed on the same computer as the printstream processor 102 or another computer on the same network.

FIG. 4 depicts three electronic mail pieces 404, 406, and 408, which may be produced by electronic inserter 110. Each electronic mail piece, e.g. piece 404, comprises a document 410 obtained from electronic delivery printstream 224, which was split from raw printstream 200 by printstream processor 102. The electronic mail piece also includes electronic mail data instructions 412 derived from the corresponding record in the electronic mail run datafile 222, and insert instructions 404 derived from job setup file 402.

Inserts for each batch of mail are defined by a job setup. For example, a record in the mail run datafile 220 may call

for insert 1, which may be targeted marketing material for ski vacations in Vermont. In the physical inserter 106 a stack of brochures about ski resorts in Vermont may be loaded for insertion. In the case of the electronic inserter 110, for a particular batch of mail, the insert needs to be developed in a format appropriate for each delivery mechanism.

Accordingly, the job setup for this batch of mail, e.g. job setup file 402, contains a set of templates and inserts for each delivery mechanism. The job setup for the web server delivery mechanism may specify the URL of a home page for a Vermont ski resort. If the delivery mechanism is electronic mail, the corresponding insert may specify a text memo to be attached to an electronic mail message. It is possible for a job setup to specify no appropriate insert for a specific delivery mechanism, e.g. fax. It is noted that templates may specify logos and standard information to be included in each document. Job setups may also specify "hot-links," which are inserts with no corresponding physical counterparts, for example, a corporate logo on a corporate web page.

Job setups can also specify a generic notification message for each delivery mechanism available for notification. For example, a fax may be sent to a recipient, informing the recipient that a web page includes his latest statement, for example a monthly billing statement. Generic notification messages are not personalized, and so can be predefined for an entire job or batch of mail pieces.

Referring to FIG. 5, job setups may be defined by a job setup process 520 (not shown in FIG. 1). The job setup process is an interactive application that allows a user to select templates and inserts for each delivery mechanism from a library. For example, electronic mail library 500 includes templates for formatting electronic mail messages. Fax library 502 may include templates and inserts as text files and text attachments to be sent along with a fax. Web library 504 includes the inserts in the form of URLs (web page addresses), PDF (Postscript Display Format, a portable display standard), or HTML (Hyper-Text Markup Language) files, which are common on the World Wide Web. Thus, the job setup process 520 prompts the user for templates, HTML files, text attachments, e.g. through a dialog box or a form for each electronic delivery mechanism. The job setup process 520 records and enables editing of the user's selections of templates and inserts for each electronic delivery mechanism. The output of the job setup process 520 is a job setup file, e.g. job setup file 402 and job setup file 518.

Referring back to FIG. 4, electronic inserter 110 applies job setup file 402 to a batch of mail pieces in the electronic delivery printstream 224 for producing electronic mail pieces 404, 406, and 408 with the appropriate insert instructions, e.g. insert instructions 414. The electronic inserter 110 also reads out corresponding records from electronic mail run datafile 222 for generating the application electronic delivery information 412 in each electronic mail piece. Furthermore, the electronic inserter 110 stores status information about each electronic mail piece in interlock file 400. Each electronic mail piece is placed on a server executing message router 112, which may be a separate server from the mail server upon which the electronic inserter 110 is executed.

Message Routing

The message router 112 detects that a new electronic mail piece has been received from the electronic inserter 110. The message router 112 decodes the delivery preference data 322

and 324, which was derived from the corresponding record in electronic mail run datafile 222 and appended to the electronic mail piece as electronic mail delivery instructions 412 by electronic inserter 110. Message router 112 sends the electronic mail piece to an output server subsystem 113 (shown in FIG. 1) for actual delivery. For example, if web server 116 is specified by the first delivery preference 322, the output server subsystem 113 sends the electronic mail piece to web server 116. The system may be configured to wait for a preset amount of time, e.g. four days, for the recipient to access the web page where the electronic mail piece was delivered. If the recipient has not accessed the web page in the preset amount of time, the electronic mail piece is considered not to be delivered. For other delivery mechanisms, the delivery failure may be detected more directly, e.g., in the case of a busy signal for a fax number.

If the electronic mail piece is not delivered according to the delivery mechanism specified in the first delivery preference 322, the corresponding document is processed according to the second delivery preference 324 until all the delivery preferences have been exhausted. Status for each electronic mail piece is reported to status/regeneration processor 118 and stored in the interlock file 400. It is important for the message router 112 to be provided with a complete electronic delivery package, that is an electronic mail piece with insert instructions 414 for each electronic delivery mechanism, because the electronic mail piece may be in process for many days after the electronic inserter 110 has processed the entire batch. For example, the message router 112 may have to wait days for the Web server 116 to be accessed before utilizing the second delivery option.

The message router 112 communicates with the electronic inserter 110 through message files. For example, a separate downloaded configuration file (not shown) may specify whether to stop processing or ignore when an attachment file is missing. There is also communication for indicating that error conditions have been fixed and that the message router 112 should restart processing if stopped.

Status/Regeneration Processor

The interlock file 400 is used for checking document status and determining which electronic mail pieces need to be regenerated if all the electronic delivery mechanisms have proved unsuccessful. In particular, the status/regeneration processor 118, which may be a program executing on mail server 600 in FIG. 6, scans the interlock file 400 for documents whose status indicates that regeneration is necessary. For physical mail pieces this may occur because the physical inserter 106 generated a bad insert, e.g. an insert jammed. For electronic mail pieces, regeneration may be necessary for those electronic mail pieces that have not been successfully delivered.

Accordingly, the regeneration processor 118 outputs a "regen" file 602 containing the piece identifiers 300 of the documents that need to be regenerated, printed by printer 104, and processed by physical inserter 106.

While the present invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiment, but, on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

What is claimed is:

1. A system for generating mail pieces for delivery to recipients in one of printed or electronic form comprising:

- a printstream processor to receive a printstream, said printstream including mail piece data corresponding to a plurality of mail pieces, each one of said plurality of mail pieces intended for a respective recipient, said printstream processor separating said printstream into at least one of a physical delivery printstream and an electronic delivery printstream based on a respective preference prescribed by each respective recipient;
- a printer coupled to the printstream processor for printing the physical delivery printstream to create a plurality of printed documents, each of said printed documents corresponding to a respective one of said plurality of mail pieces that is to be delivered in a printed form;
- an inserter system coupled to the printer for generating mail pieces in printed form, wherein each mail piece in printed form includes one of the plurality of printed documents and wherein at least one of the mail pieces in printed form include respective printed inserts;
- an electronic inserter coupled to the printstream processor for separating the electronic delivery printstream into a plurality of electronic documents, each of said electronic documents corresponding to a respective one of said plurality of mail pieces that is to be delivered in electronic form, and for generating mail pieces in electronic form, wherein each mail piece in electronic form includes one of the plurality of electronic documents and wherein at least one of the mail pieces in electronic form includes respective electronic inserts; and
- a message router coupled to the electronic inserter for delivering the mail pieces in electronic form.

2. The system of claim 1, further comprising a regeneration processor for receiving piece status information, said regeneration processor causing a mail piece corresponding to a mail piece in electronic form to be generated in printed form if the piece status information of the mail piece in electronic form indicates that the electronic mail piece has not been received by an intended recipient within a predetermined period of time.

3. The system of claim 1, wherein the message router is configured to deliver at least one of the mail pieces in electronic form to a World Wide Web server and wherein the electronic insert corresponding to the at least one of the mail pieces in electronic form is a link to a page on the World Wide Web.

4. The system of claim 1, wherein the message router is configured to deliver at least one of the mail pieces in electronic form via electronic mail.

5. The system of claim 1, wherein the message router is configured to deliver at least one of the mail pieces in electronic form to a facsimile machine.

6. The system of claim 1, wherein the message router is configured to selectively deliver the mail pieces in electronic form by one of a plurality of delivery mechanisms based on recipient preference.

7. The system of claim 6, wherein the message router is configured to send a notification message by another of the plurality of delivery mechanisms confirming delivery of the mail pieces in electronic form.

8. A method for generating mail pieces for delivery to recipients in one of printed or electronic form comprising: receiving a printstream, said printstream including mail piece data corresponding to a plurality of mail pieces, each one of said plurality of mail pieces intended for a respective recipient;

separating said printstream into at least one of a physical delivery printstream and an electronic delivery print-

stream based on a respective preference prescribed by each respective recipient;

printing the physical delivery printstream to create a plurality of printed documents, each of said printed documents corresponding to a respective one of said plurality of mail pieces that is to be delivered in a printed form;

generating mail pieces in printed form, wherein each mail piece in printed form includes one of the plurality of printed documents and wherein at least one of the mail pieces in printed form include respective printed inserts;

separating the electronic delivery printstream into a plurality of electronic documents, each of said electronic documents corresponding to a respective one of said plurality of mail pieces that is to be delivered in electronic form;

generating mail pieces in electronic form, wherein each mail piece in electronic form includes one of the plurality of electronic documents and wherein at least one of the mail pieces in electronic form includes respective electronic inserts; and

delivering the mail pieces in electronic form.

9. The method of claim 6, further comprising:

receiving piece status information about one of said mail pieces in electronic form; and

generating in printed form a mail piece corresponding to a mail piece in electronic if the piece status information of the mail piece in electronic form indicates that the electronic mail piece has not been received by an intended recipient within a predetermined period of time.

10. The method of claim 8, wherein:

the step of delivering the mail pieces in electronic form includes delivering at least one of the mail pieces in electronic form to a World Wide Web server, and

the step of generating the mail pieces in electronic form includes inserting a link to a page on the World Wide Web.

11. The method of claim 8, wherein the step of delivering includes delivering at least one of the mail pieces in electronic form via electronic mail.

12. The method of claim 8, wherein the step of delivering includes delivering at least one of the mail pieces in electronic form to a facsimile machine.

13. The method of claim 8, wherein the step of delivering includes selectively delivering the mail pieces in electronic form by one of a plurality of delivery mechanisms based on recipient preference.

14. The method of claim 13, further comprising:

sending a notification message by another of the plurality of delivery mechanisms confirming delivery of the mail pieces in electronic form.

15. A method for generating mail pieces as recited in claim 8, further comprising the steps of:

providing a plurality of instruction templates, wherein each template identifies a format corresponding to one of a plurality of electronic delivery mechanisms;

associating each mail piece in electronic form with at least one of the plurality of instruction templates; and

wherein the step of delivering the mail pieces in electronic form further comprises delivering the mail pieces in electronic form by one of the plurality of electronic delivery mechanisms associated with the at least one of the plurality of instruction templates.

16. A method for generating mail pieces as recited in claim 15 further including the steps of:

associating at least one mail piece in electronic form with at least first and second templates, wherein the first template provides a first choice electronic delivery mechanism and the second template provides a second choice delivery mechanism.

17. A method for generating mail pieces as recited in claim 16 further including the steps of:

determining if the at least one mail piece in electronic form was delivered by the first choice electronic delivery mechanism; and

delivering the at least one mail piece in electronic form by the second choice delivery mechanism if the at least one mail piece in electronic form was determined not to be delivered by the first choice delivery mechanism.

18. A method for generating mail pieces as recited in claim 17, further including the step of:

waiting a predefined amount of time before performing the determining step.

19. A method for generating mail pieces as recited in claim 15 further including the step of:

notifying a recipient, by a method other than the electronic mechanism used to deliver the mail piece, that a mail piece in electronic form has been delivered by an electronic delivery mechanism.

20. A method for generating mail pieces as recited in claim 19 wherein the step of notifying a recipient includes the step of notifying a recipient with a facsimile message indicating that the mail piece in electronic form has been delivered.

21. A method for generating mail pieces as recited in claim 16 wherein the delivery mechanism is selected to deliver the mail piece in electronic form in accordance with one of the following delivery methods: an e-mail message; a pager message; a facsimile message or a site on the world wide web.

22. A method for generating mail pieces as recited in claim 15 further including the steps of:

providing insert instructions with each electronic mail piece indicating what electronic inserts are to be associated with the electronic mail piece; and

wherein the step of delivering mail pieces in electronic form further includes delivering electronic inserts in accordance with the insert instructions.

23. A method for generating mail pieces as recited in claim 15 further including the step of:

encrypting the mail piece in electronic form before delivering it to a recipient.

24. A system for generating mail pieces as recited in claim 1 further comprising:

a database having a plurality of instruction templates, wherein each template corresponds to one of a plurality of electronic delivery mechanisms;

a computer processor for associating each electronic mail piece with at least one instruction template; and

wherein the message router delivers the electronic mail pieces and respective electronic insert mail pieces by one of the plurality of electronic delivery mechanisms in accordance with the at least one instruction template.

25. A system for generating mail pieces as recited in claim 24, wherein the message router is configured to deliver at least one of the electronic mail pieces to a World Wide Web server and the electronic insert is a link to a page on the World Wide Web.

11

26. A system for generating mail pieces as recited in claim 24, wherein the message router is configured to deliver at least one of the electronic mail pieces via electronic mail.

27. A system for generating mail pieces as recited in claim 24, wherein the message router is configured to deliver at least one of the electronic mail pieces to a pager.

28. A system for generating mail pieces as recited in claim 24, wherein the message router is configured to deliver at least one of the electronic mail pieces to a facsimile machine and the electronic insert is a document.

12

29. A system for generating mail pieces as recited in claim 24, wherein the message router is configured to selectively deliver the electronic mailpieces to a web server, an electronic mail address, a facsimile machine, and a printer.

30. A system for generating mail pieces as recited in claim 24, wherein the message router is configured to send a notification message by one of the plurality of delivery mechanisms.

* * * * *

United States Patent [19]
Scullion et al.

[11] **Patent Number:** 4,734,865

[45] **Date of Patent:** Mar. 29, 1988

[54] **INSERTION MACHINE WITH AUDIT TRAIL
AND COMMAND PROTOCOL**

[75] **Inventors:** Christopher K. Scullion; Bruce A.
Muschlitz, both of Bethlehem, Pa.

[73] **Assignee:** Bell & Howell Company, Chicago,
Ill.

[21] **Appl. No.:** 837,625

[22] **Filed:** Mar. 10, 1986

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 823,427; Jan. 28, 1986,
abandoned.

[51] **Int. Cl.⁴** G06F 15/20; B65H 39/02

[52] **U.S. Cl.** 364/478; 53/266 A;
53/500; 270/58; 364/131

[58] **Field of Search** 364/478, 479, 464, 465,
364/466, 471, 131-136; 270/53-58; 53/495,
500, 502, 540, 266 A; 271/258, 259, 3.1, 4, 2, 3

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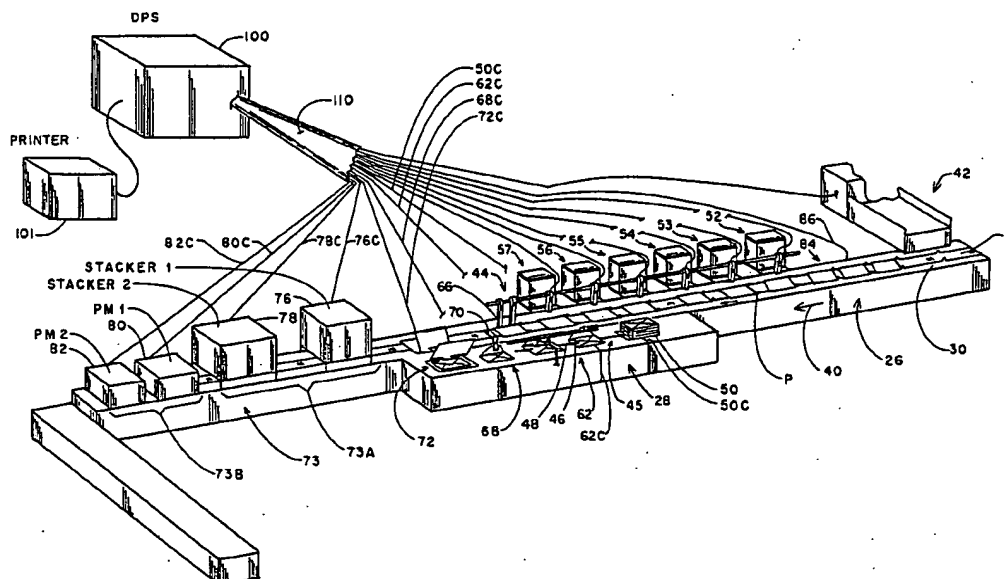
4,639,873 1/1987 Baggary et al. 364/466

Primary Examiner—Joseph Ruggiero

[57] **ABSTRACT**

Processing events of an insertion machine are managed by a first data processor (DPS1) 100'. The DPS 100' is connected to a second data processor (DPS2) 700 by a data transmission cable 703 whereby the DPS1 sends data formatted in accordance with a plurality of 95-TO-PC COMMANDS to the DPS2 700 and whereby the DPS2 700 sends data formatted in accordance with a plurality of PC-TO-95 COMMANDS to the DPS1 100'. Some of the PC-TO-95 COMMANDS are used for downloading values for insertion machine input parameters and are generated in response to user input via a keyboard 720 as prompted by appropriate displays on a monitor 718. Other PC-TO-95 COMMANDS are generated in response to user input for interrogating the DPS1 100' and prompt the DPS1 100' to generate an answering 95-TO-PC COMMAND which includes insertion machine-related operating output data.

59 Claims, 51 Drawing Figures



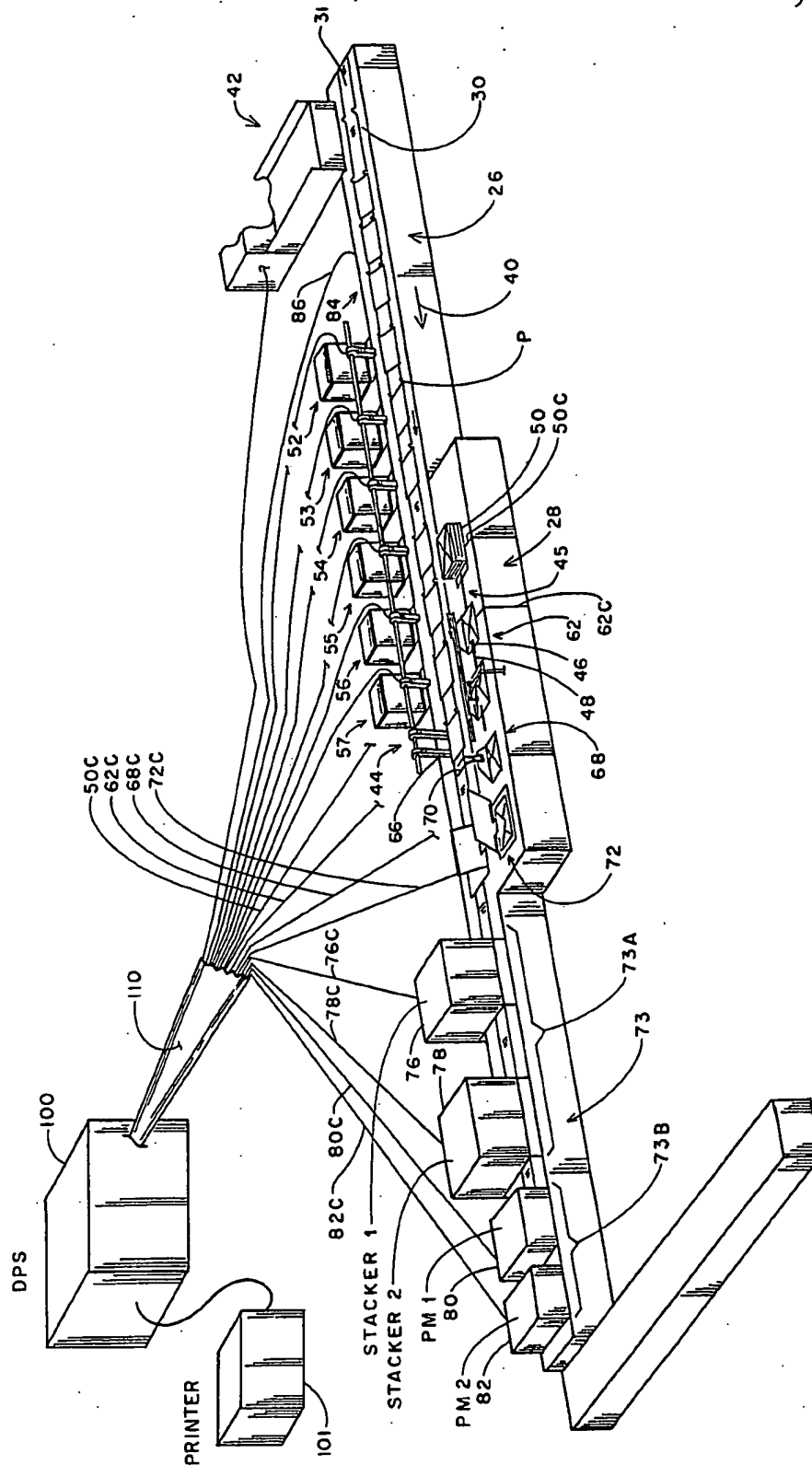
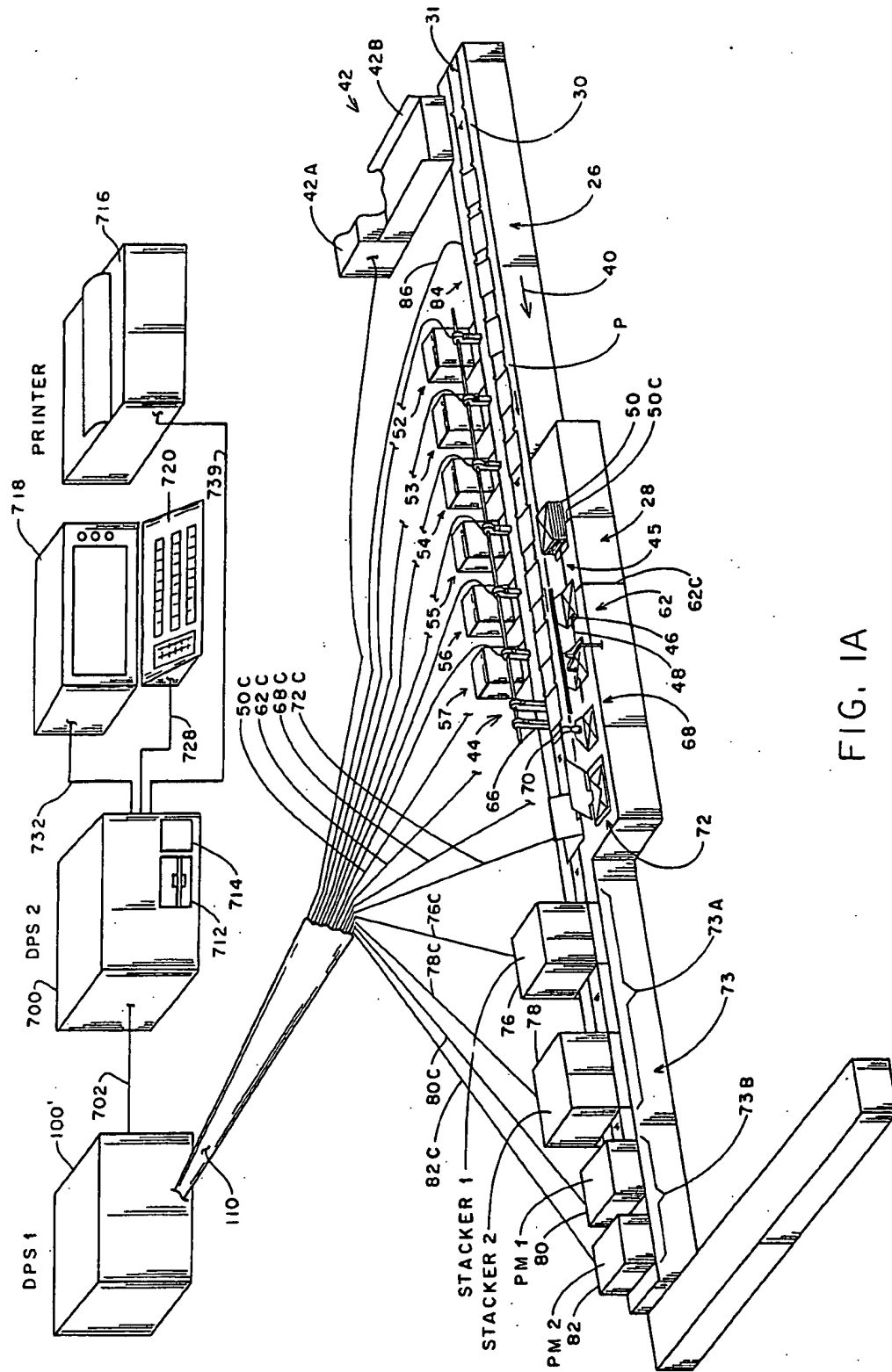


FIG. 1



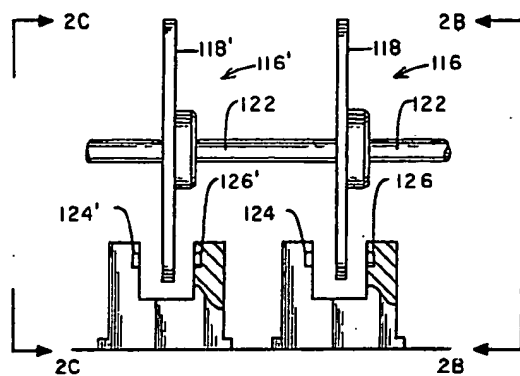


FIG. 2A

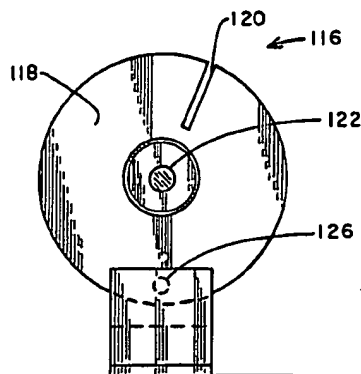


FIG. 2B

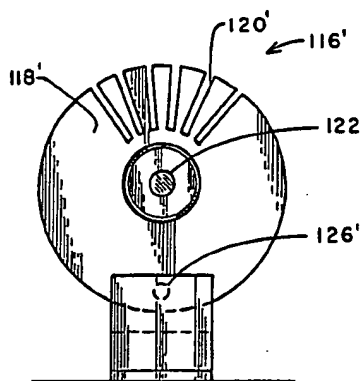


FIG. 2C

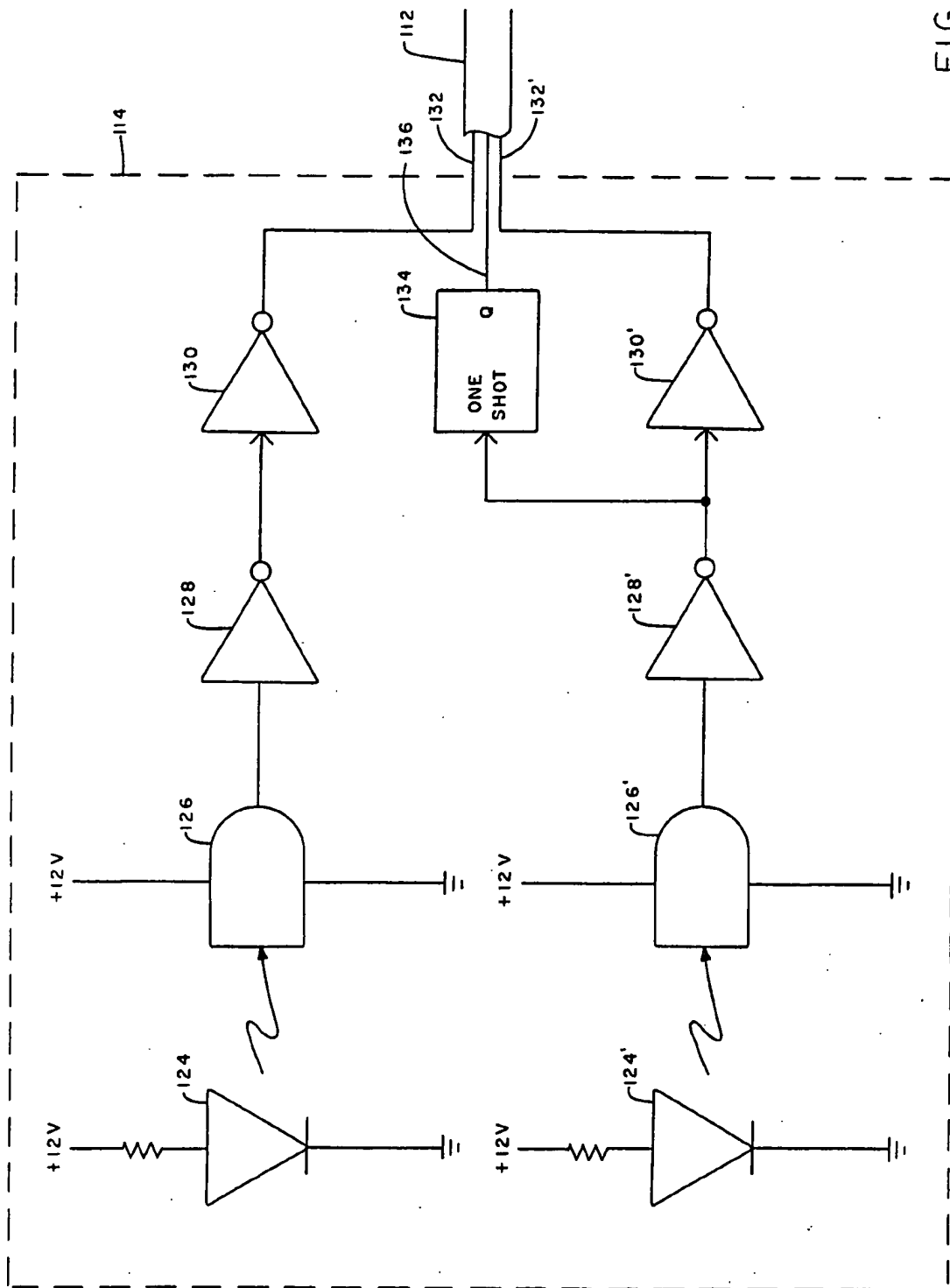
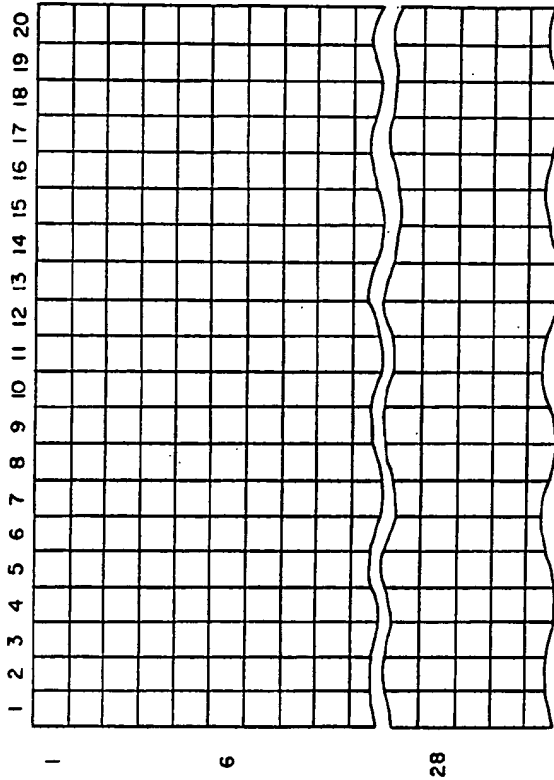
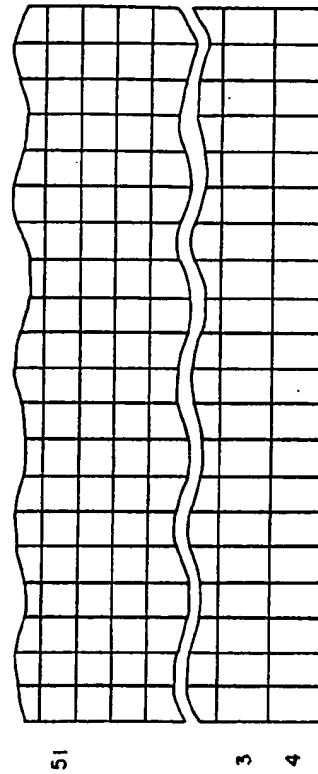


FIG. 3



SELECT FROM 1ST DOWNSTREAM READING INSERT STATION
 SELECT FROM 2ND DOWNSTREAM READING INSERT STATION
 SELECT FROM 3RD DOWNSTREAM READING INSERT STATION
 FIRST STANDARD INSERT STATION SELECT PER READ INDICIA
2ND STANDARD INSERT STATION SELECT PER READ INDICIA
3RD STANDARD INSERT STATION SELECT PER READ INDICIA
4TH STANDARD INSERT STATION SELECT PER READ INDICIA
5TH STANDARD INSERT STATION SELECT PER READ INDICIA
6TH STANDARD INSERT STATION SELECT PER READ INDICIA

STANDARD DIVERTER 1 ACTIVATION ENABLEMENT
 STANDARD DIVERTER 2 ACTIVATION ENABLEMENT
 STANDARD DIVERTER 3 ACTIVATION ENABLEMENT



POSTAGE METER 1 ACTIVATION ENABLEMENT
 POSTAGE METER 2 ACTIVATION ENABLEMENT
 POSTAGE METER 3 ACTIVATION ENABLEMENT

MATCH - TOTAL PIECE COUNT (BPCNT)
 MATCH 4 - WEIGHT (BWGHT)

FIG. 4
SBUS

	FRAME 1 (SHIFT)	FRAME 2 (WEEK)	FRAME 3 (MONTH)	FRAME 4 (QUARTER)	FRAME 5 (YEAR)
NUMBER OF DOCUMENTS FED FROM CONTROL STATION	200	201	202	203	204
NUMBER OF CUSTOMERS PROCESSED BY CONTROL STATION	205	206	207	208	209
NUMBER OF DOCUMENTS FED FROM FIRST STANDARD GRIPPER STATION	210				
NUMBER OF DOCUMENTS FED FROM SECOND STANDARD GRIPPER STATION	215				
NUMBER OF DOCUMENTS FED FROM THIRD STANDARD GRIPPER STATION	220				
NUMBER OF DOCUMENTS FED FROM FOURTH STANDARD GRIPPER STATION	225				
NUMBER OF DOCUMENTS FED FROM FIFTH STANDARD GRIPPER STATION	230				
NUMBER OF DOCUMENTS FED FROM SIXTH STANDARD GRIPPER STATION	235				
NUMBER OF CATEGORY-INCREASING DOCUMENTS FED FROM CHARGE-BACK STATION	240				
NUMBER OF ENVELOPES DIVERTED BY FIRST STACKER	245				
NUMBER OF ENVELOPES DIVERTED BY SECOND STACKER	250				
NUMBER OF ENVELOPES METERED BY FIRST POSTAGE METER	255				
NUMBER OF ENVELOPES METERED BY SECOND POSTAGE METER	260				
NUMBER OF ENVELOPES FED	265				
TOTAL NUMBER OF MACHINE STOPS	270				
NUMBER OF SYSTEM STOPS	275				
NUMBER OF STOP BAR STOPS	280				
NUMBER OF JAM STOPS	285				
NUMBER OF DOUBLE FEED STOPS	290				
NUMBER OF MISS STOPS	295				299
AUDIT COUNTERS					
LAST REFERENCED CALENDAR TIME	360				
FAULT TIME OF MACHINE FOR FRAME 1	365				
RUNNING TIME OF MACHINE FOR FRAME 1	370				
CALENDAR TIME ELAPSED FOR FRAME 1	375				
CYCLE COUNT OF MACHINE FOR FRAME 1	380				
AUDIT TIMERS					

NON-VOLATILE
MEMORY

FIG. 5

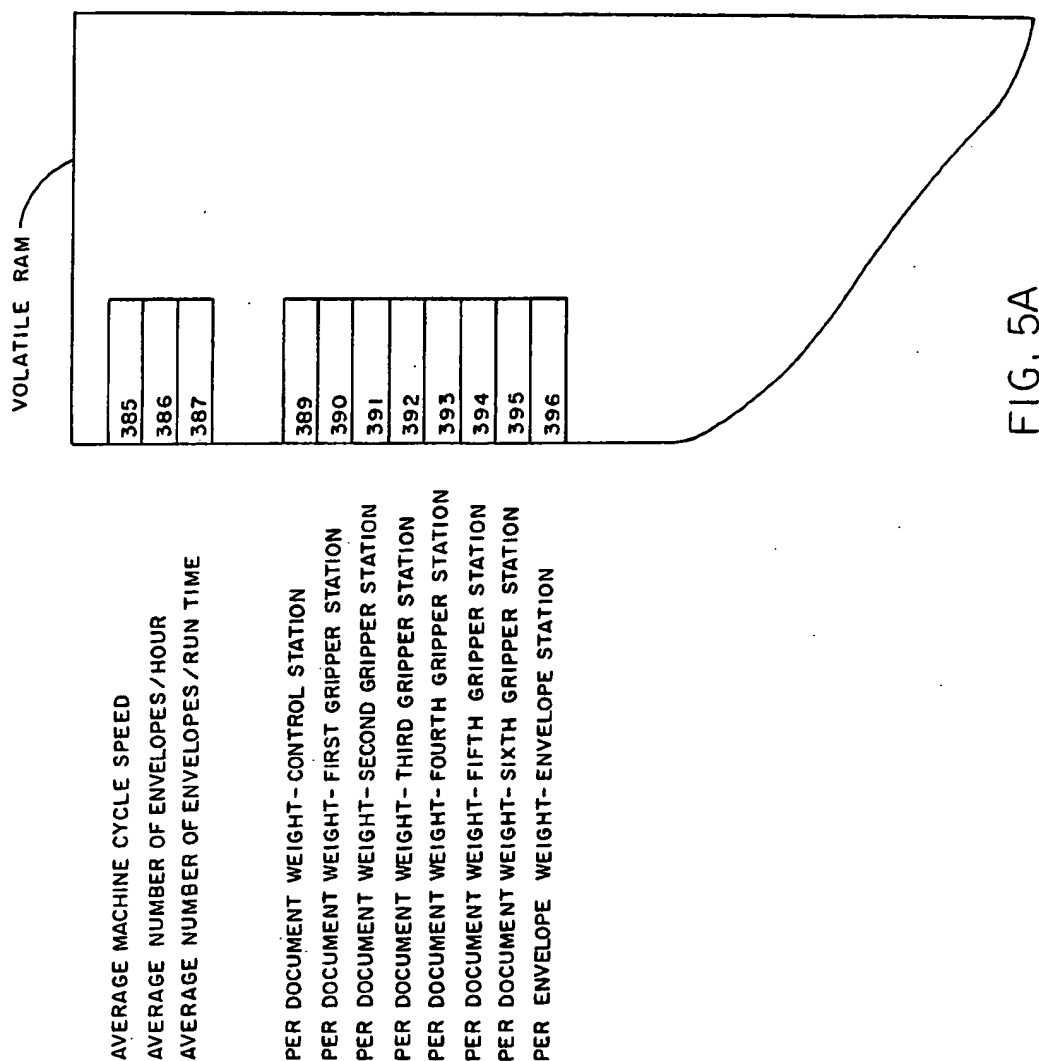


FIG. 5A

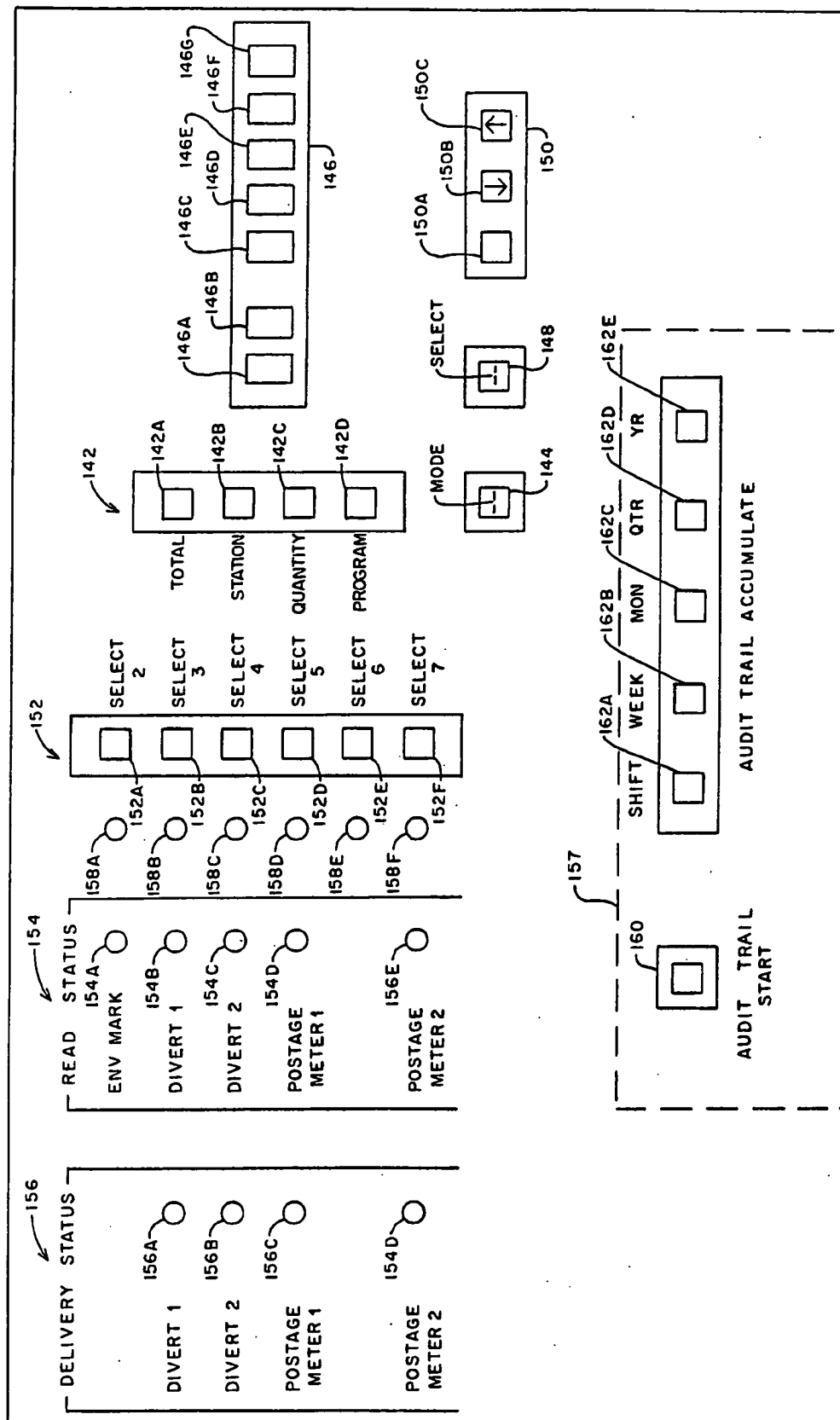
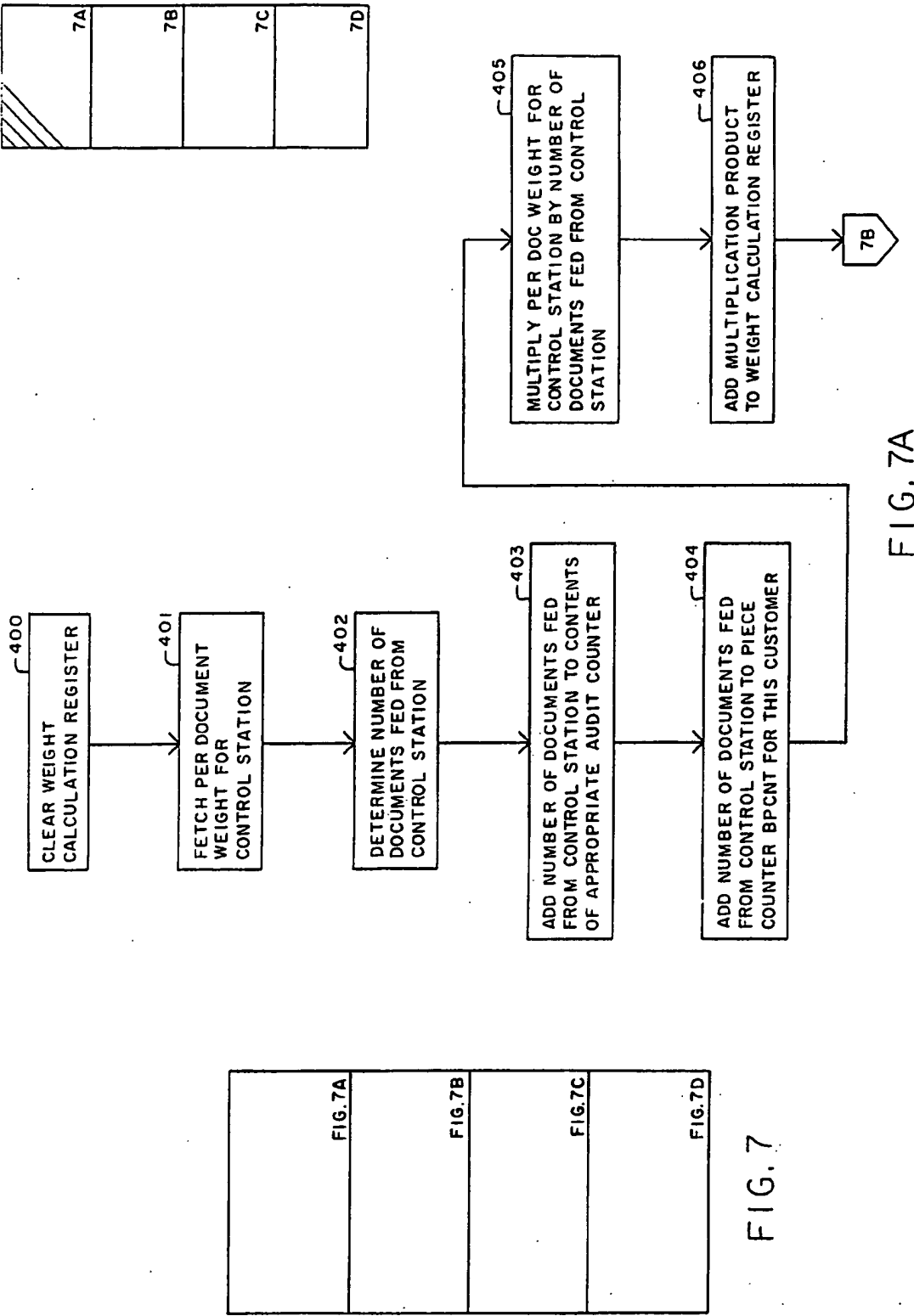


FIG. 6



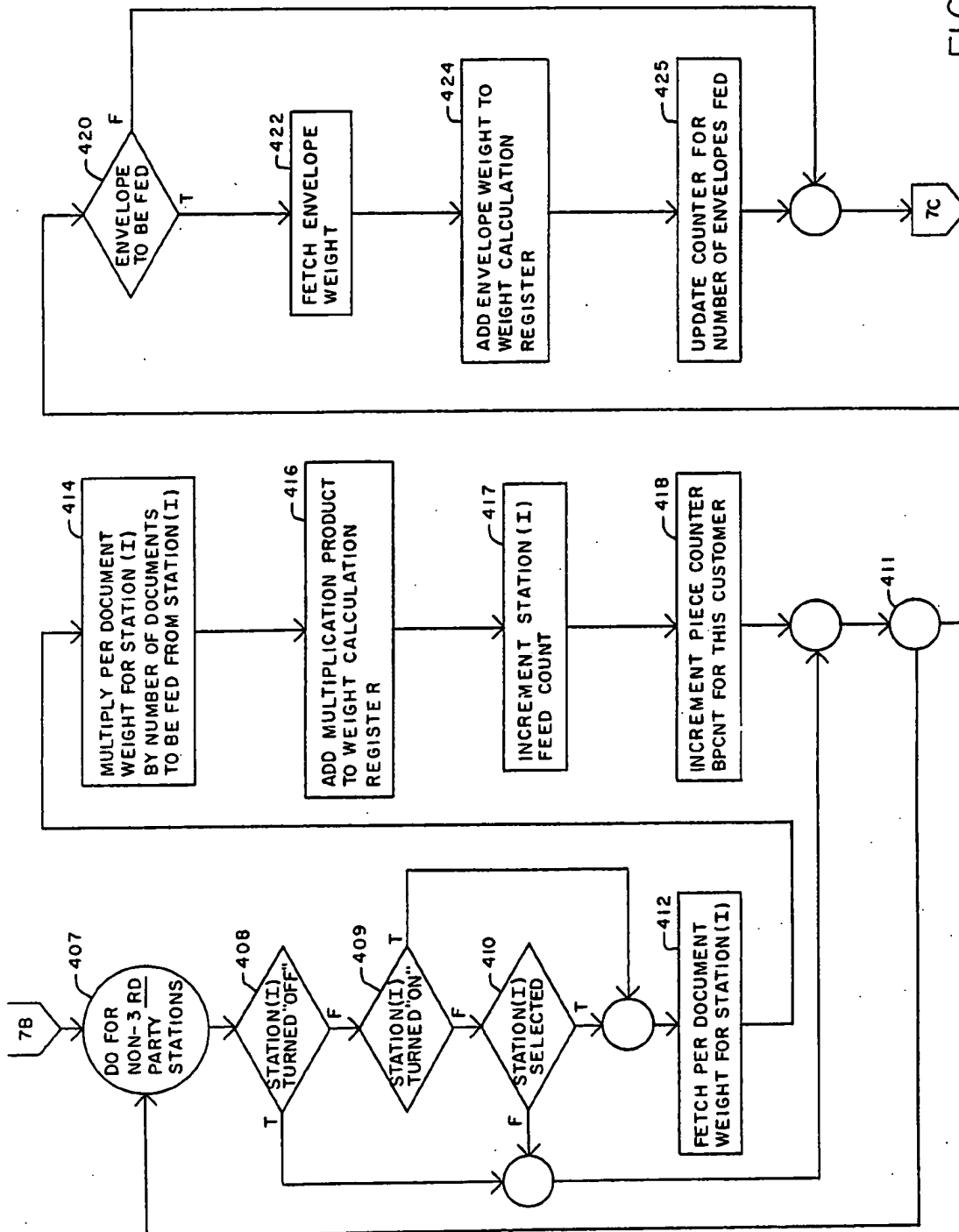
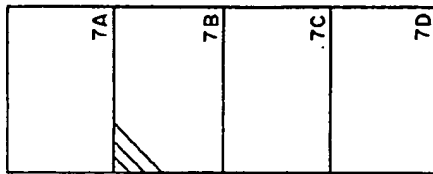


FIG. 7B

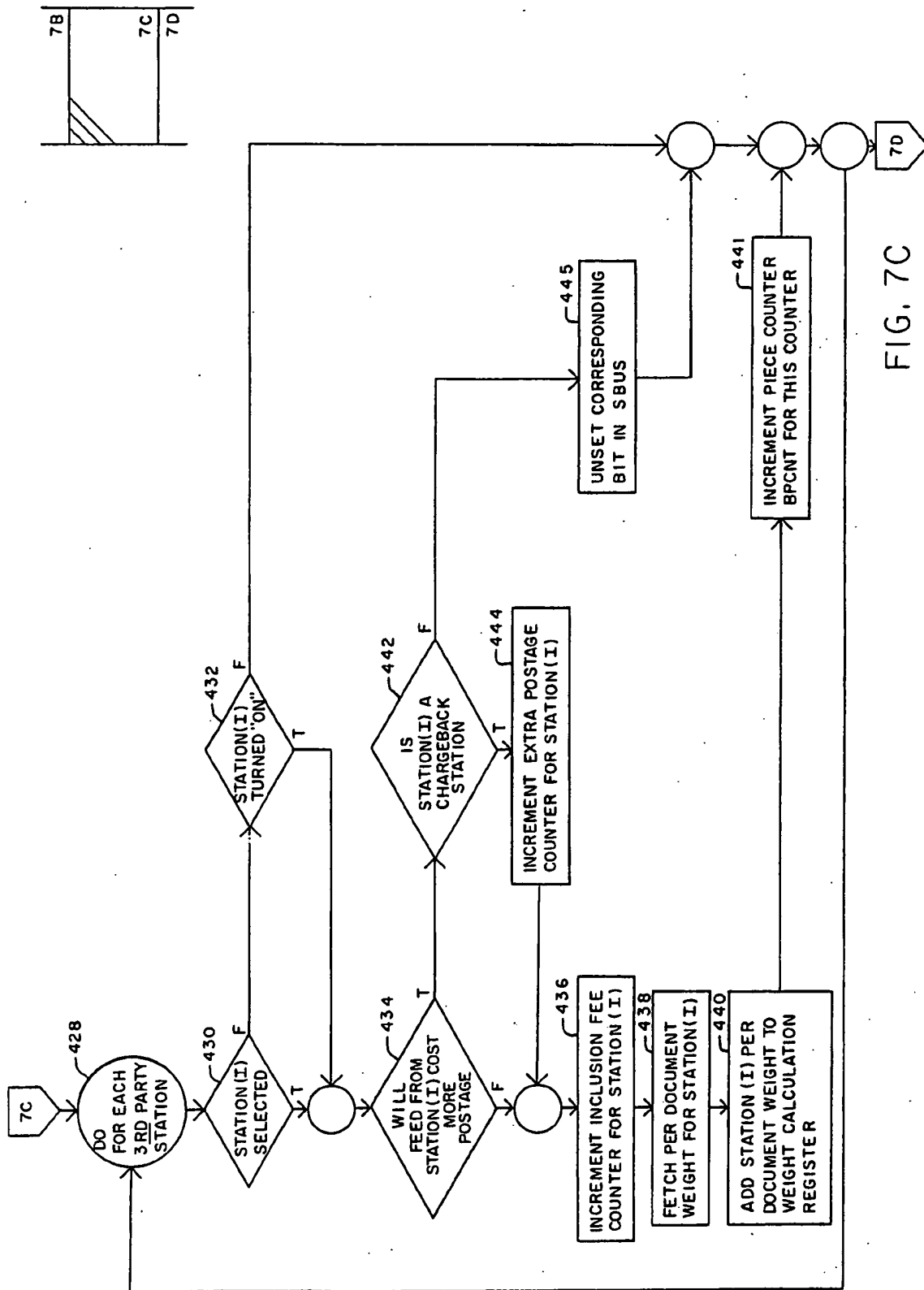


FIG. 7C

7A	7B	7C	7D

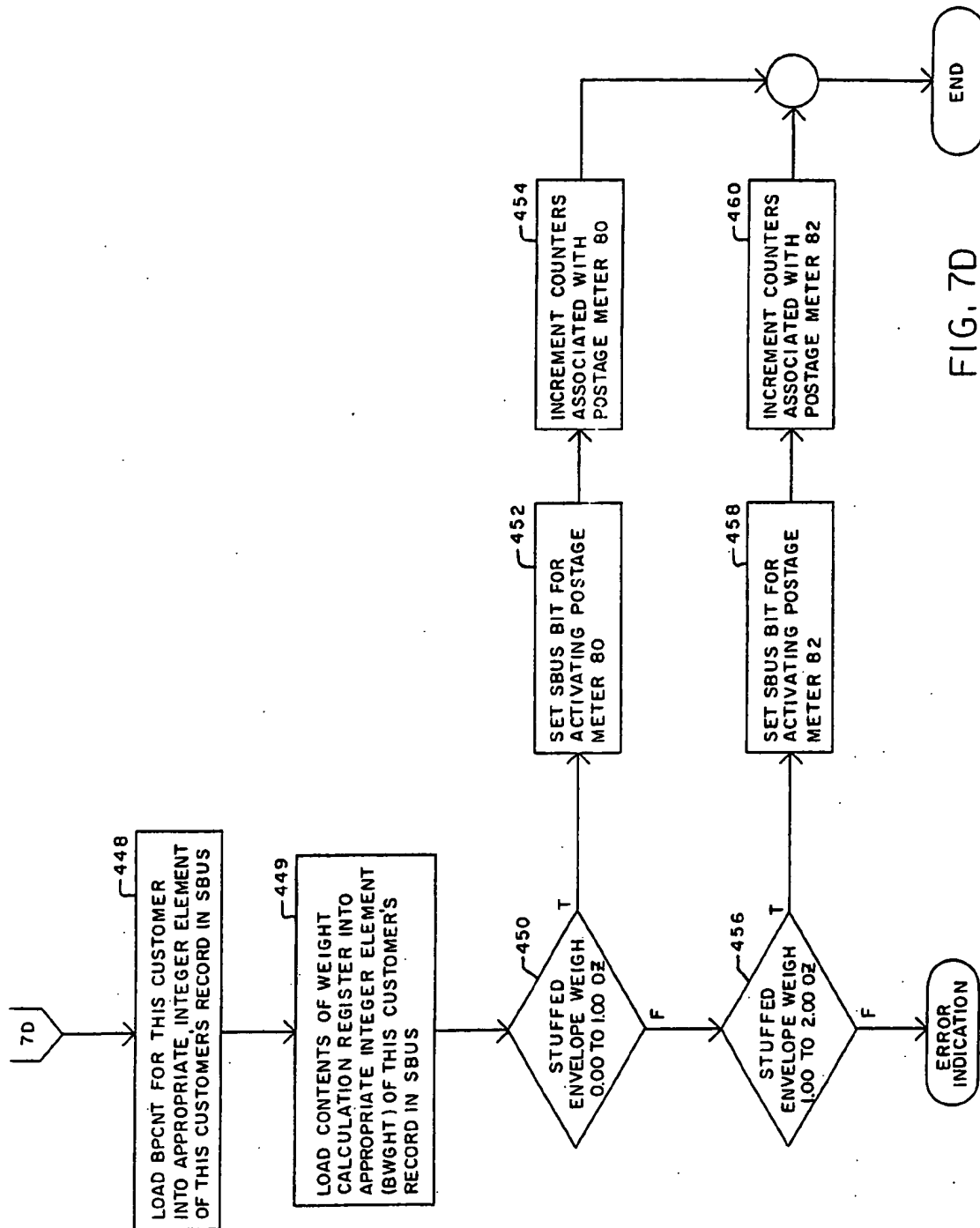
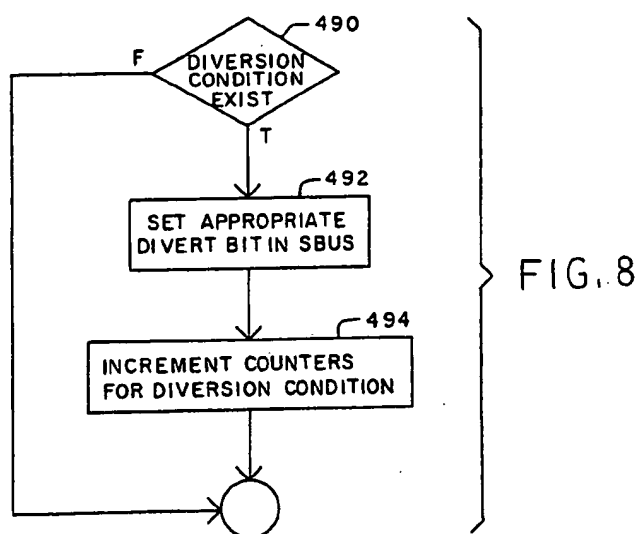


FIG. 7D



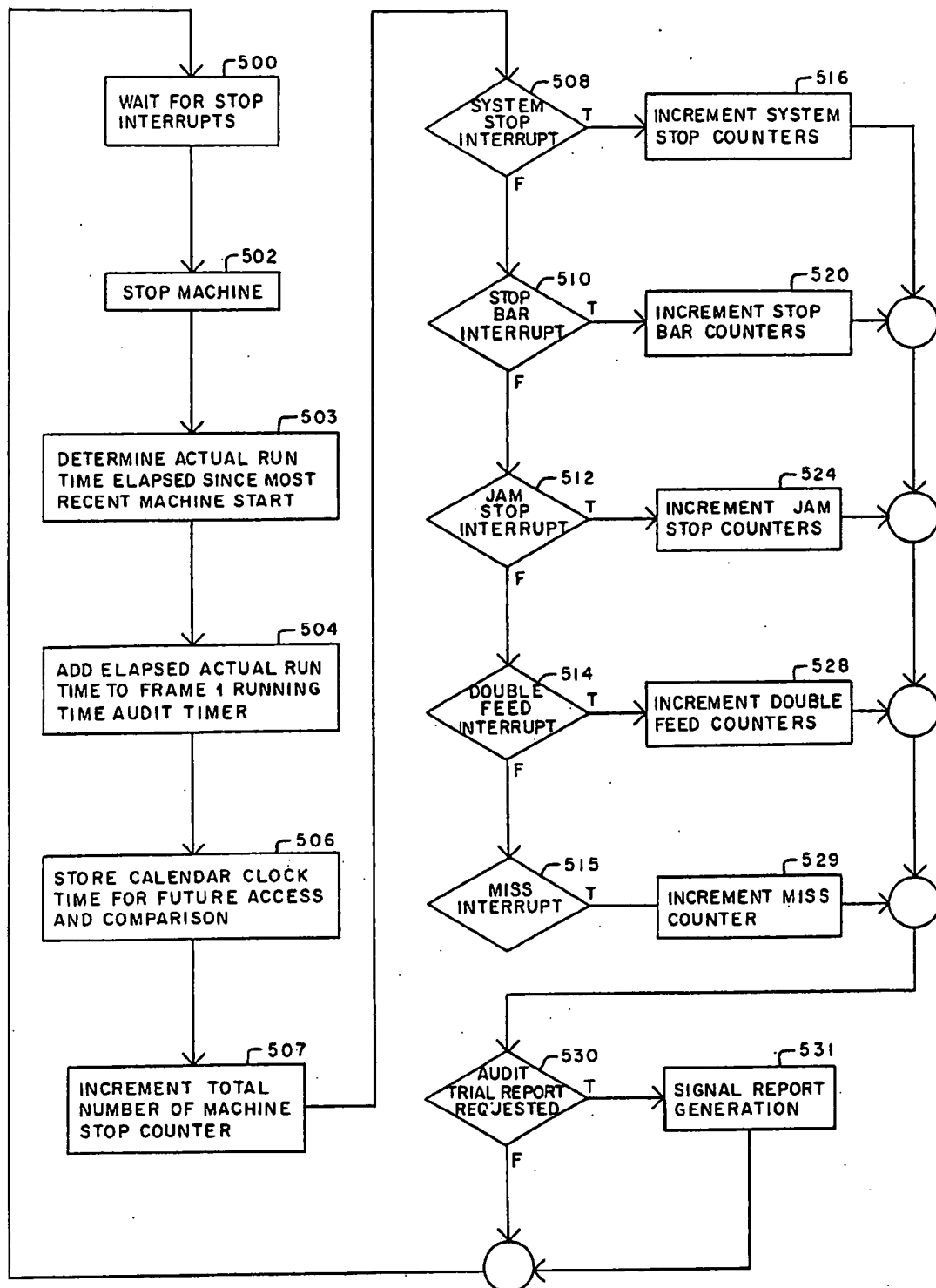


FIG. 9

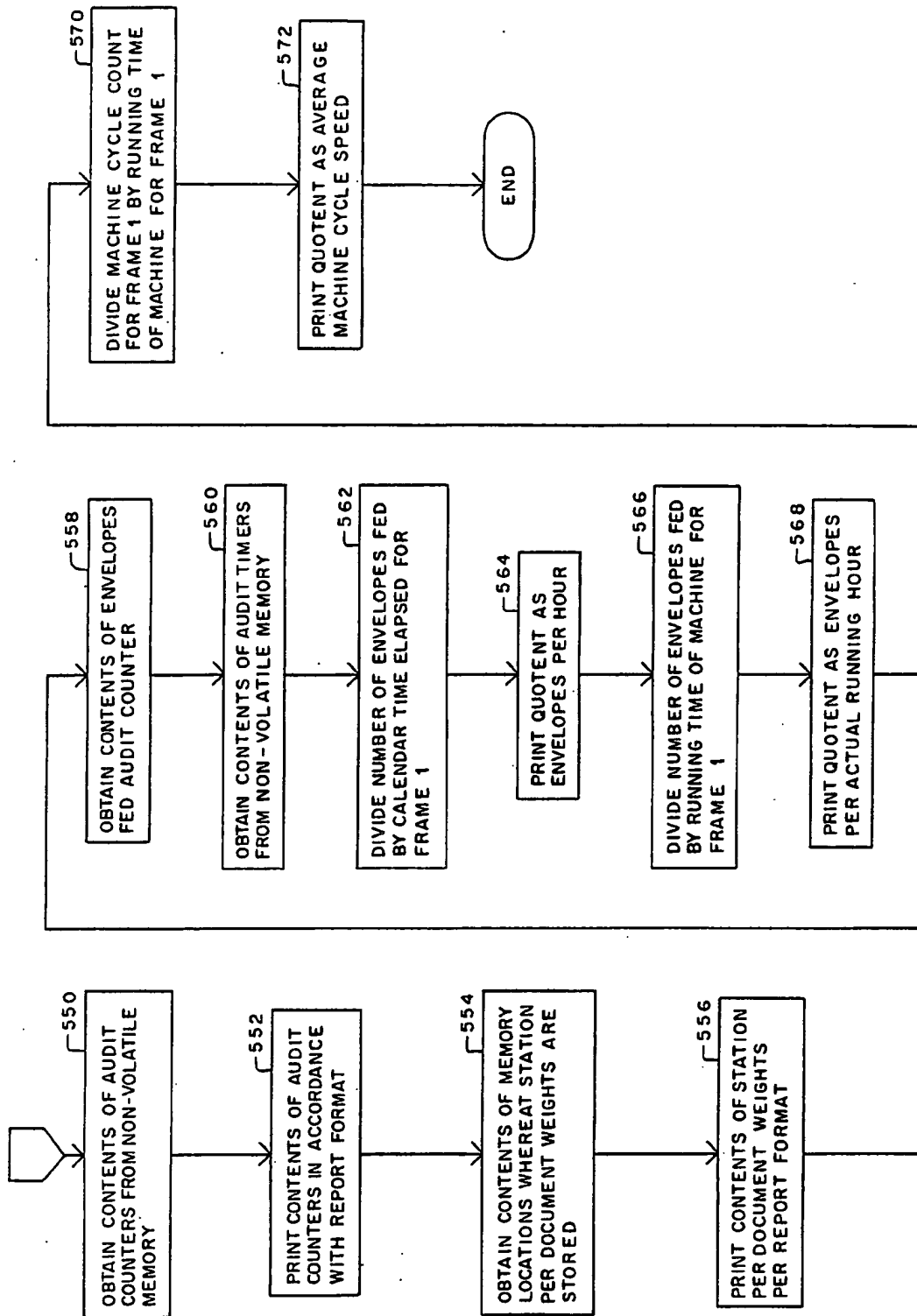


FIG. 10

	AUDIT	TRIAL	REPORT		
	SHIFT	WEEK	MONTH	QUARTER	YEAR
FEEDER 1 COUNT	_____	_____	_____	_____	_____
STANDARD STATION 1 COUNT	_____	_____	_____	_____	_____
STANDARD STATION 2	_____	_____	_____	_____	_____
STANDARD STATION 3	_____	_____	_____	_____	_____
STANDARD STATION 4	_____	_____	_____	_____	_____
STANDARD STATION 5	_____	_____	_____	_____	_____
STANDARD STATION 6	_____	_____	_____	_____	_____
ENVELOPES FED	_____	_____	_____	_____	_____
DIVERT 1 COUNT	_____	_____	_____	_____	_____
DIVERT 2 COUNT	_____	_____	_____	_____	_____
METER 1 COUNT	_____	_____	_____	_____	_____
METER 2 COUNT	_____	_____	_____	_____	_____
CHARGEBACK COUNT	_____	_____	_____	_____	_____
FEEDER 1 PER DOCUMENT WEIGHT			_____		
STANDARD STATION 1 PER DOCUMENT WEIGHT			_____		
STANDARD STATION 2 PER DOCUMENT WEIGHT			_____		
STANDARD STATION 3 PER DOCUMENT WEIGHT			_____		
STANDARD STATION 4 PER DOCUMENT WEIGHT			_____		
STANDARD STATION 5 PER DOCUMENT WEIGHT			_____		
STANDARD STATION 6 PER DOCUMENT WEIGHT			_____		
ENVELOPES PER HOUR			_____		
ENVELOPES PER ACTUAL RUNNING HOUR			_____		
AVERAGE MACHINE CYCLE SPEED			_____		

FIG. 11

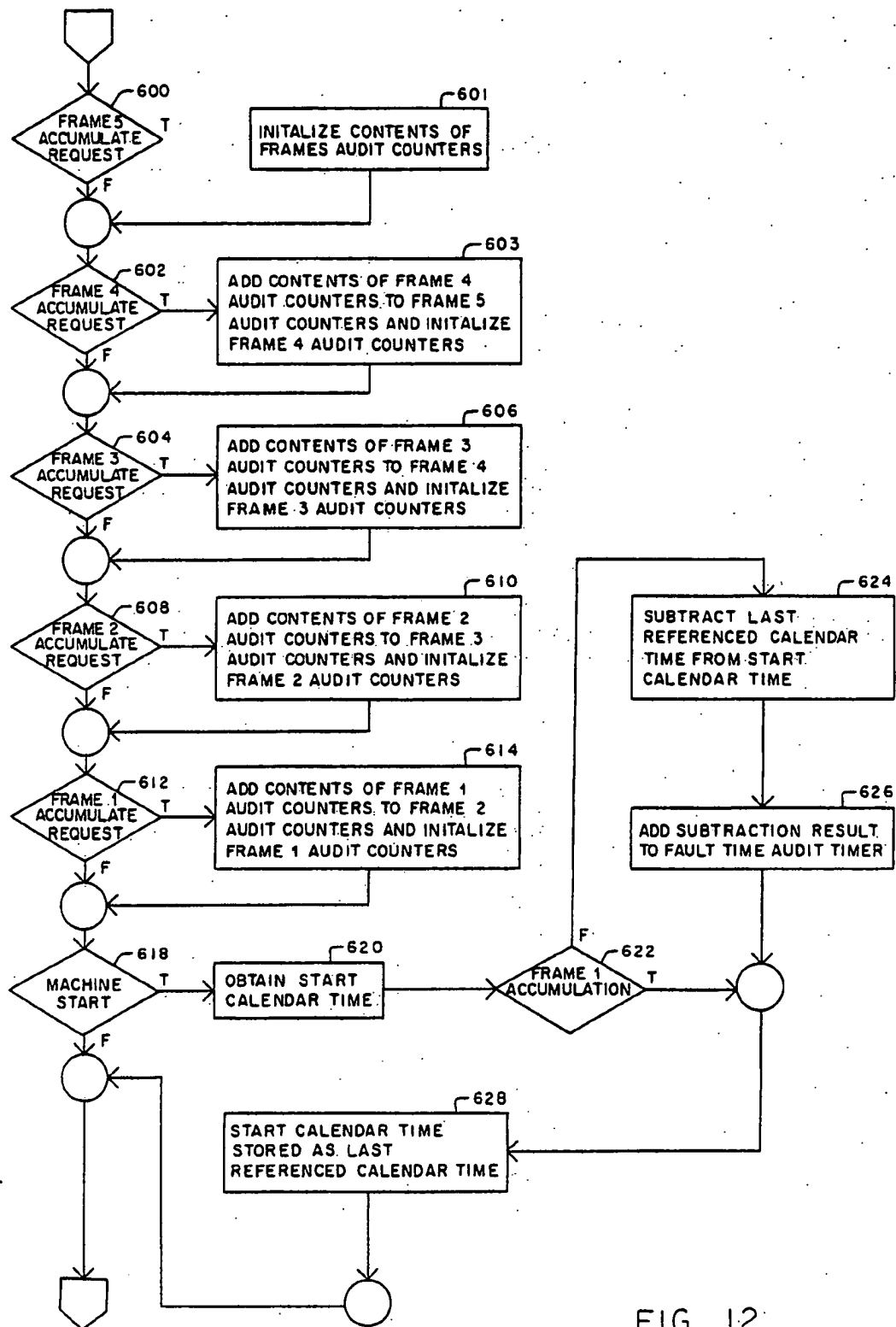


FIG. 12

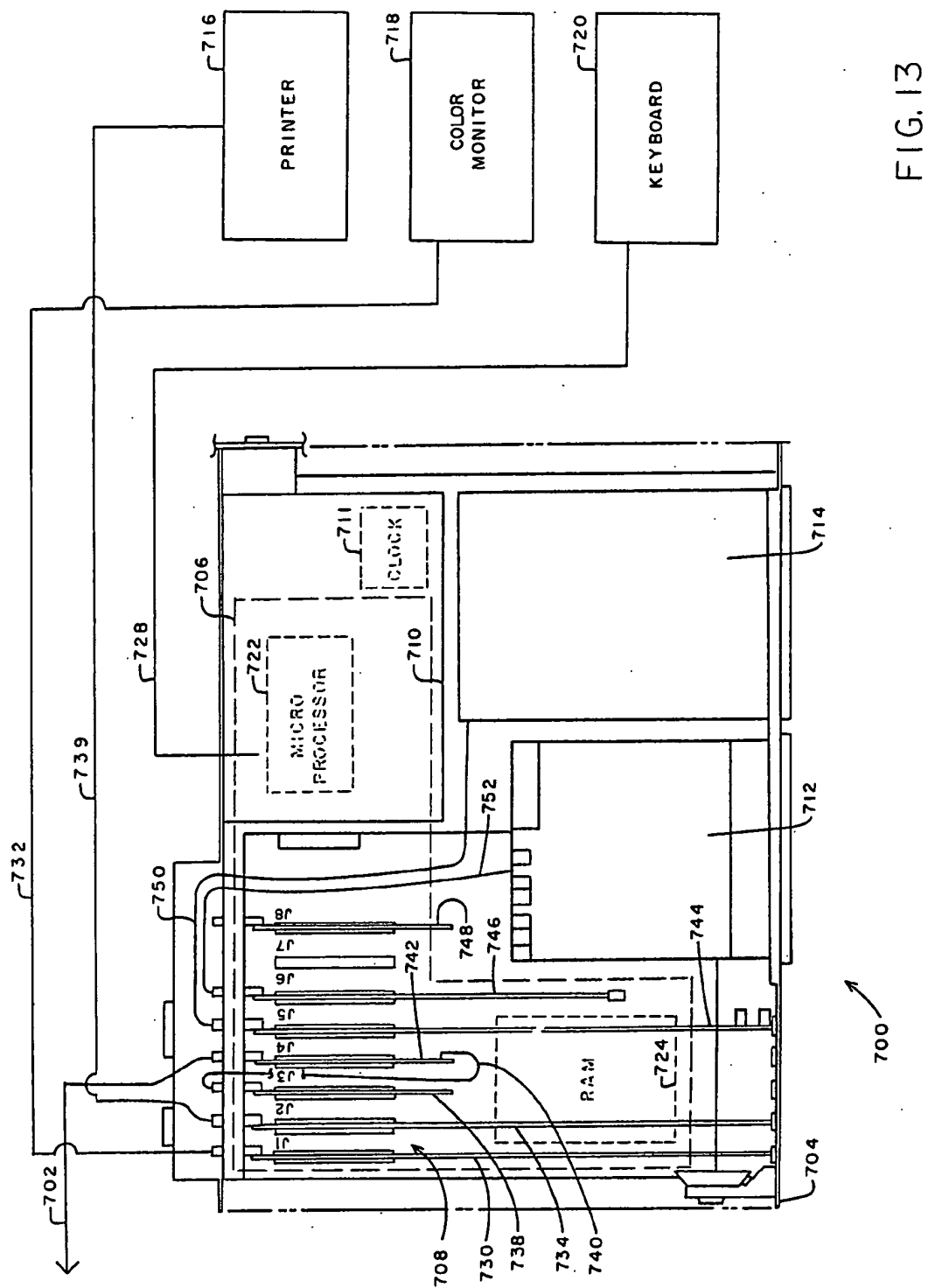
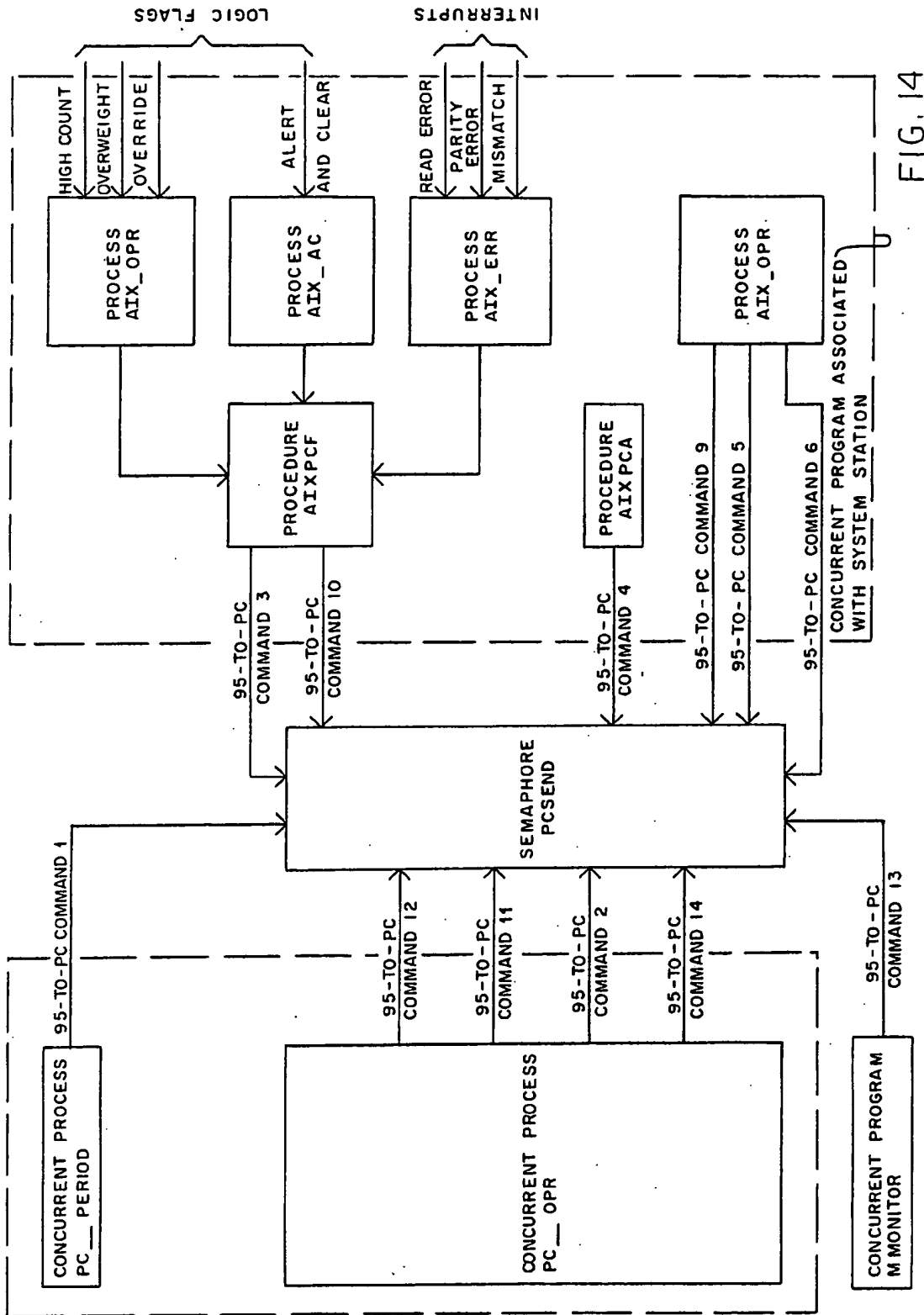


FIG. 13



IBM __ PC

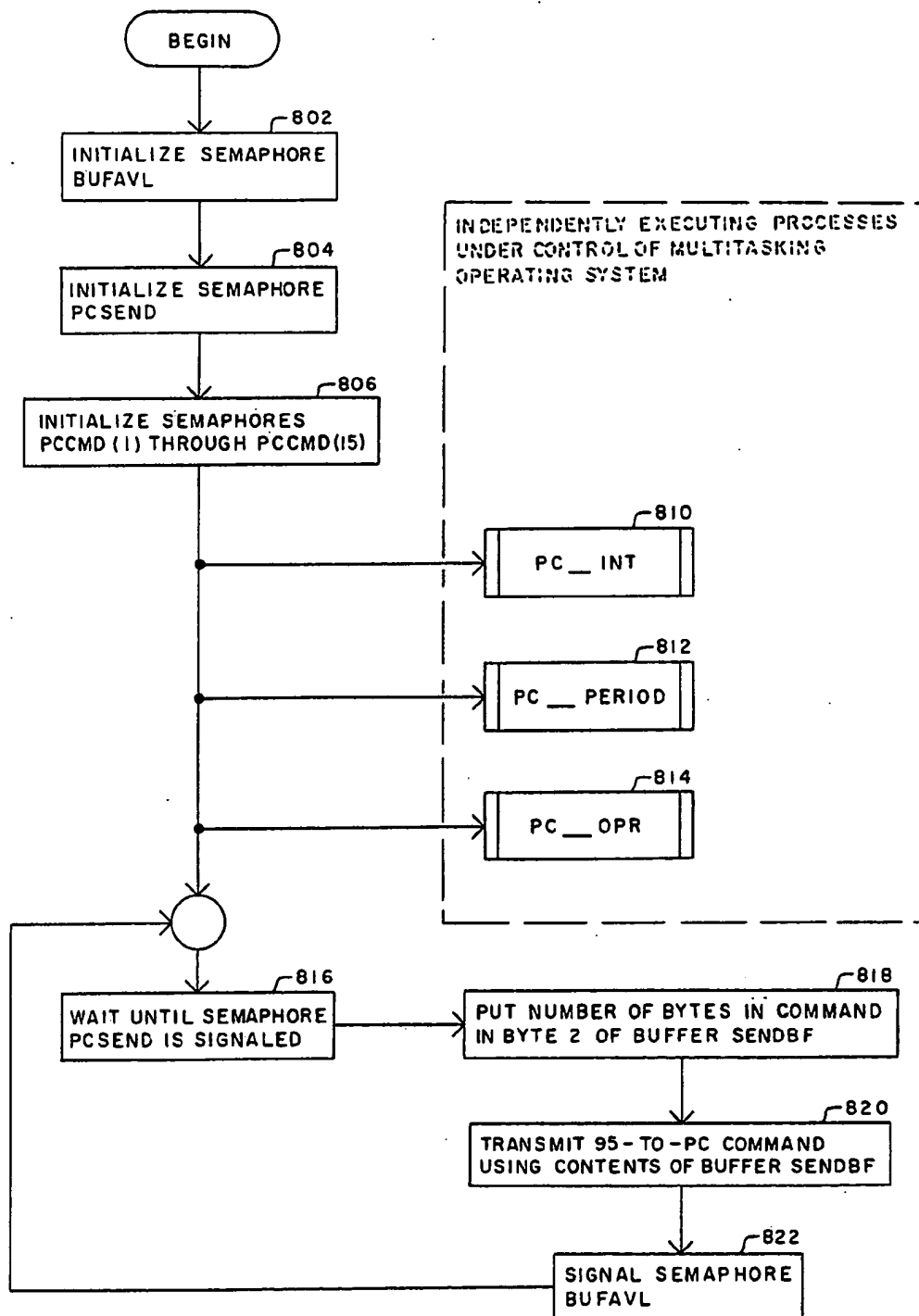


FIG. 15

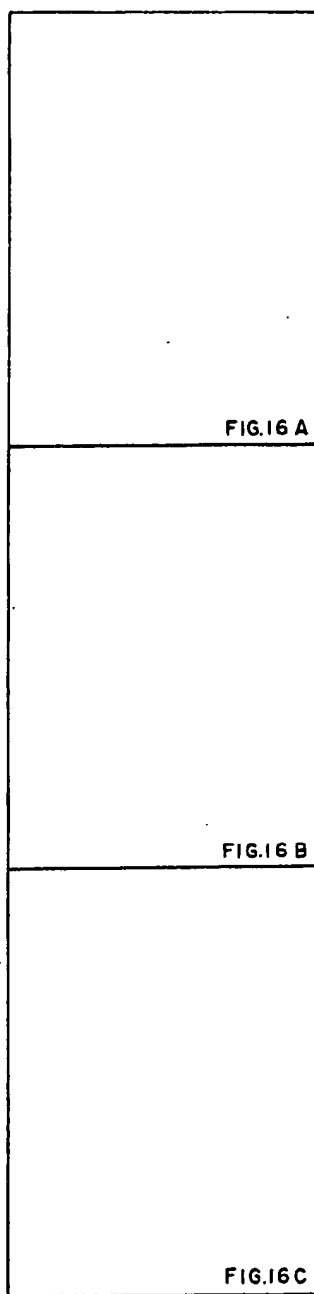
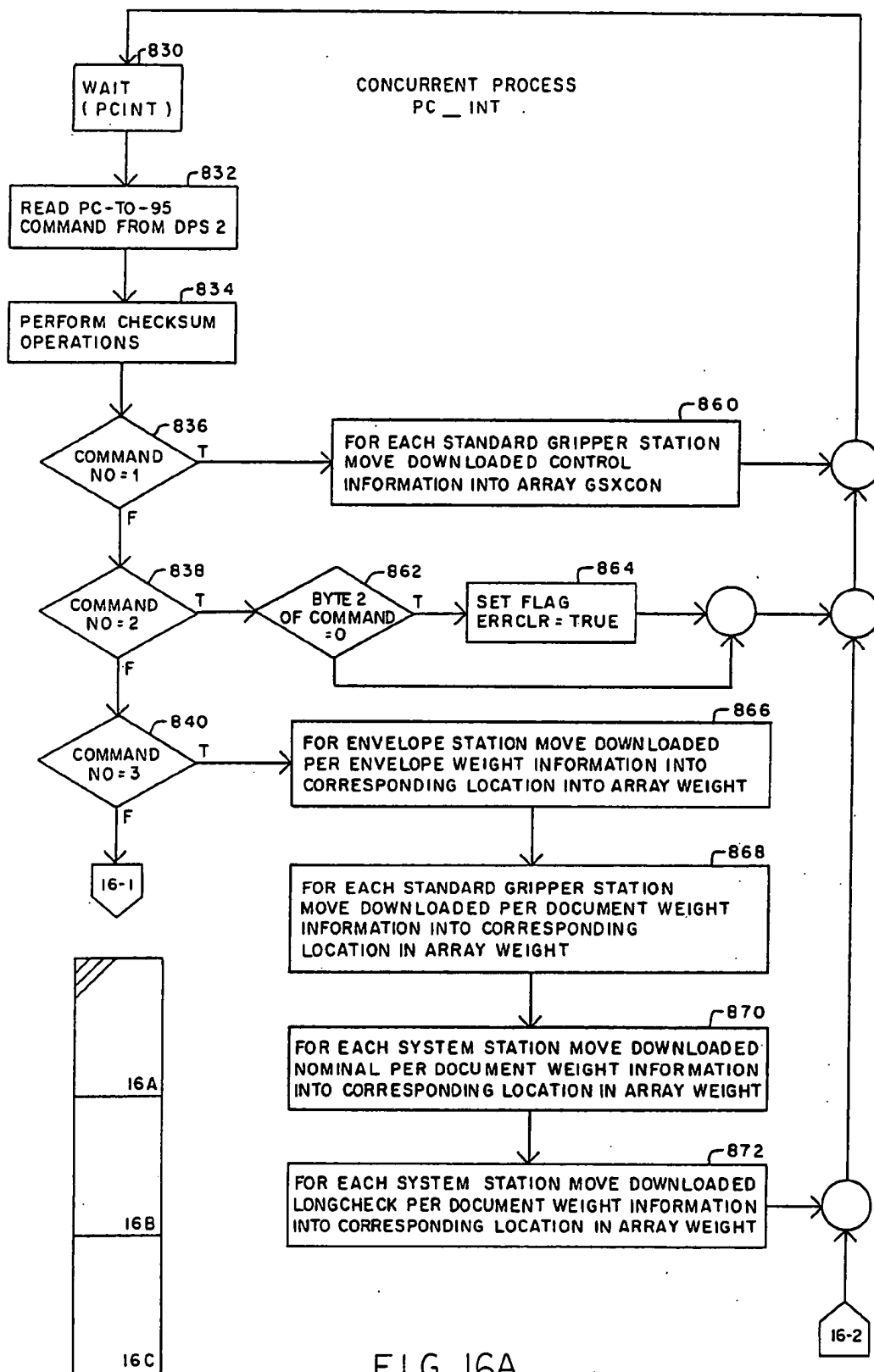
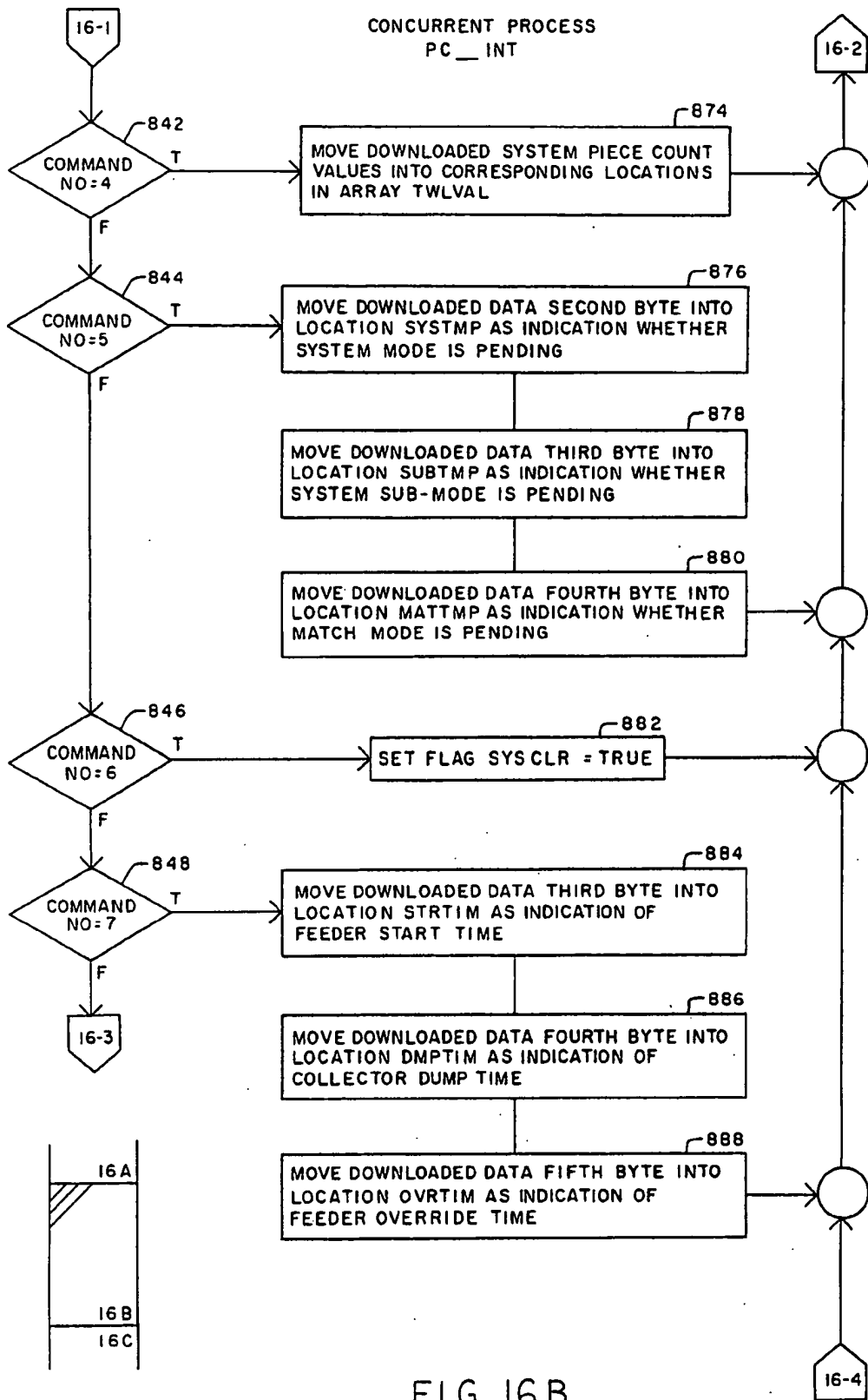


FIG. 16





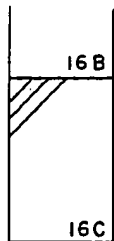
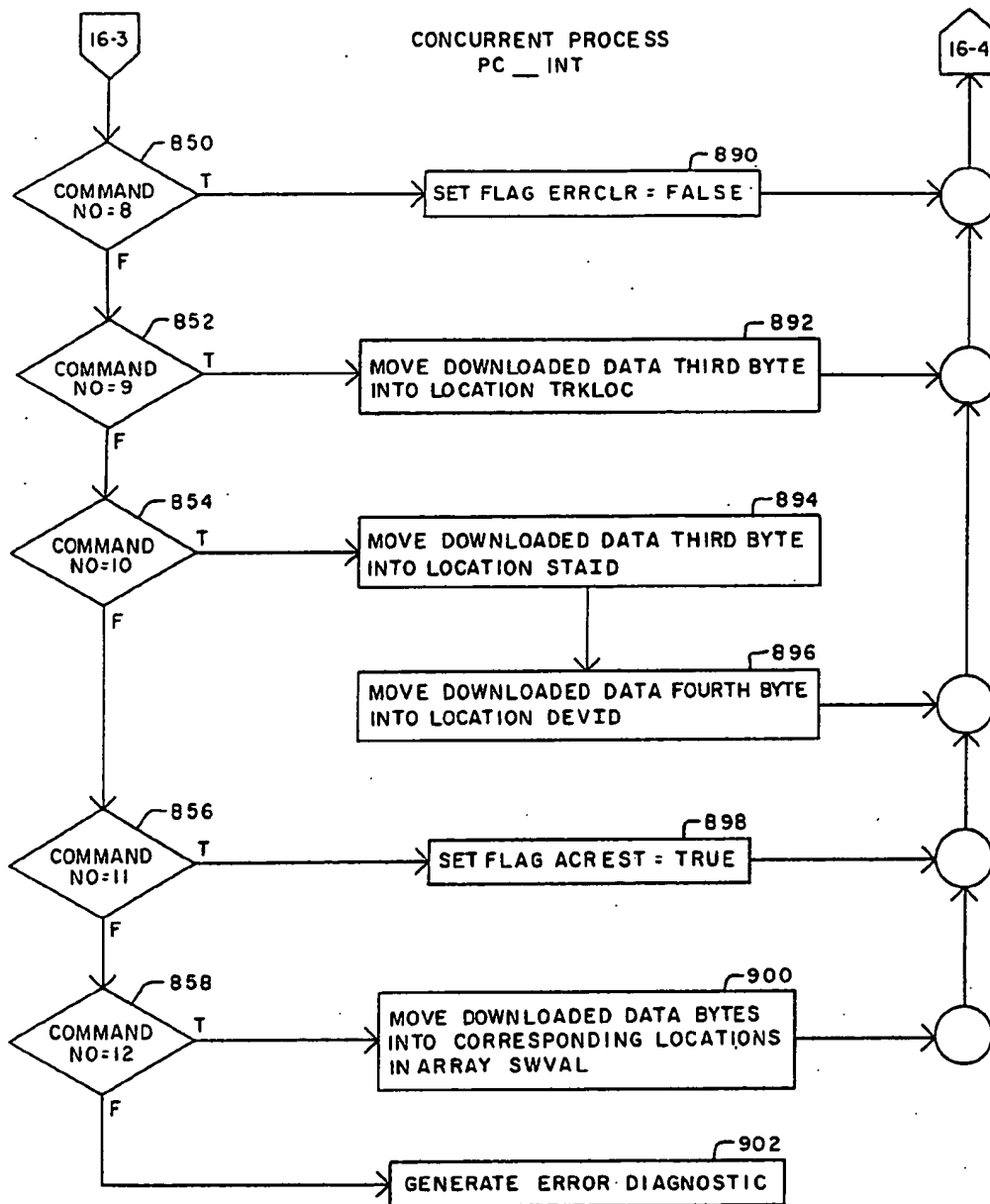


FIG. 16C

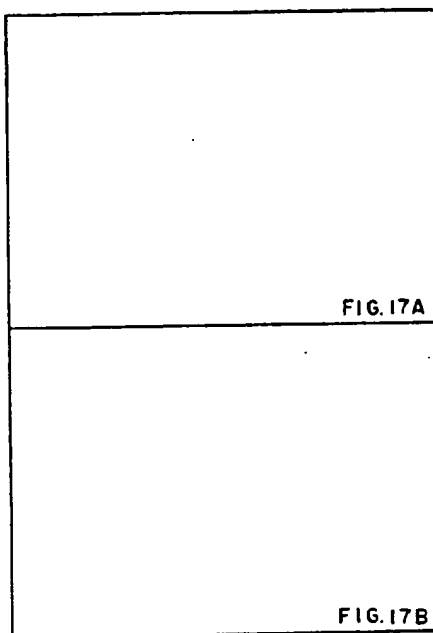
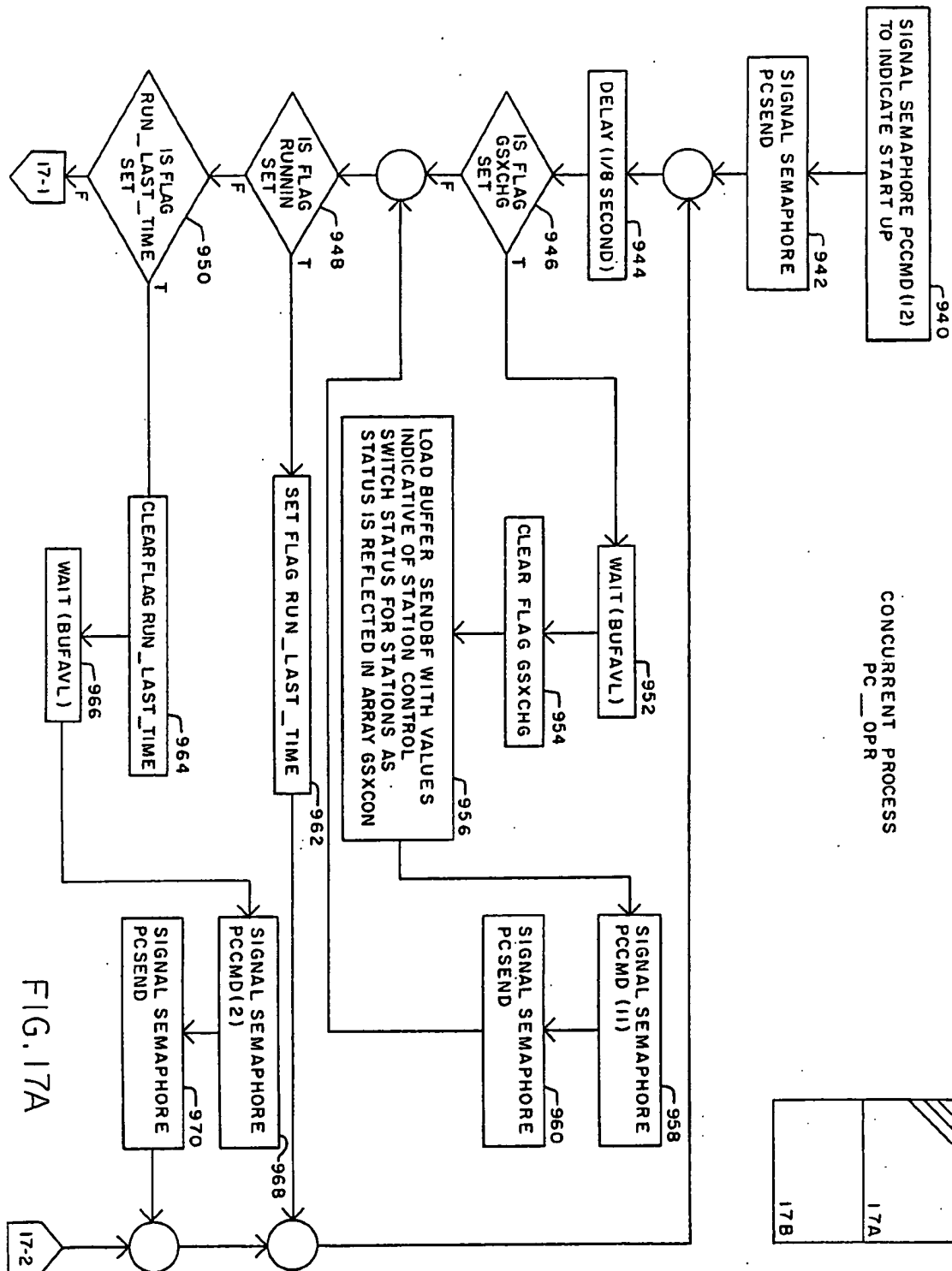


FIG. 17



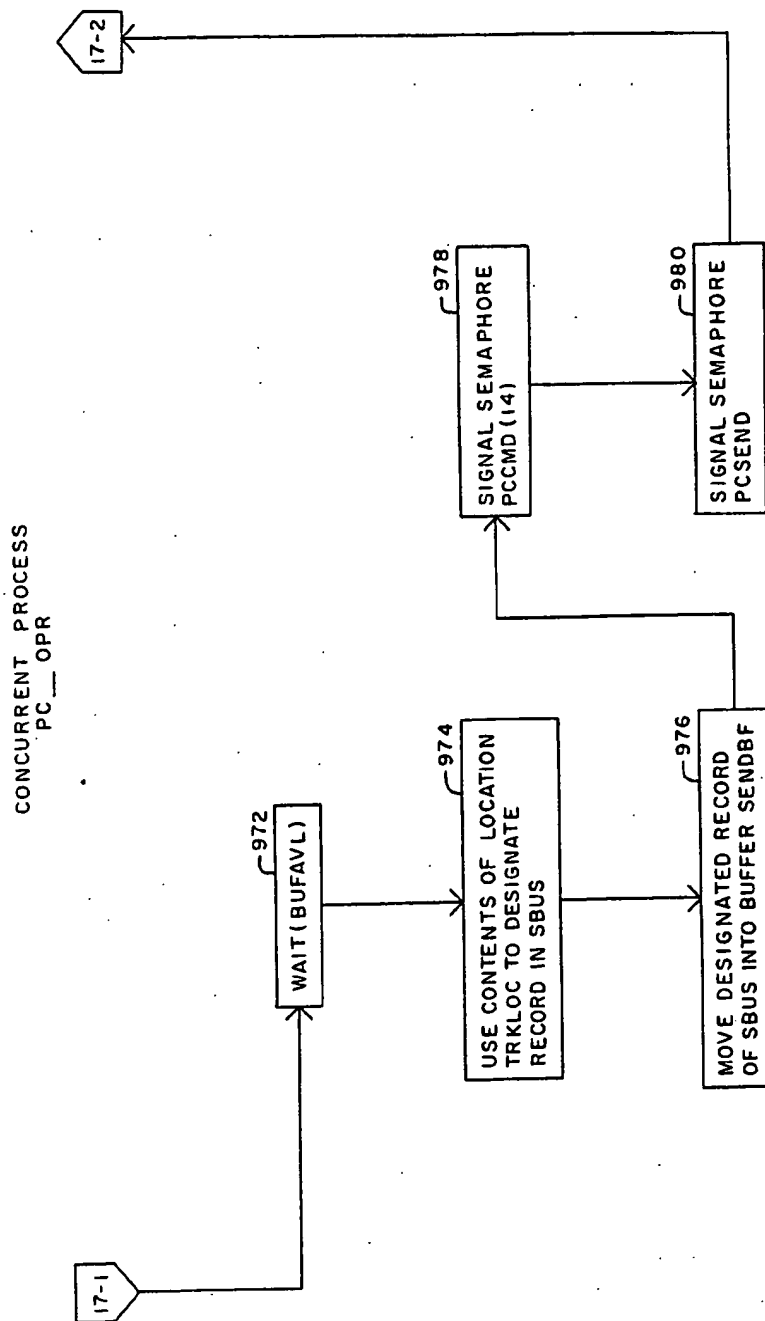
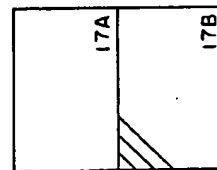


FIG. 17B



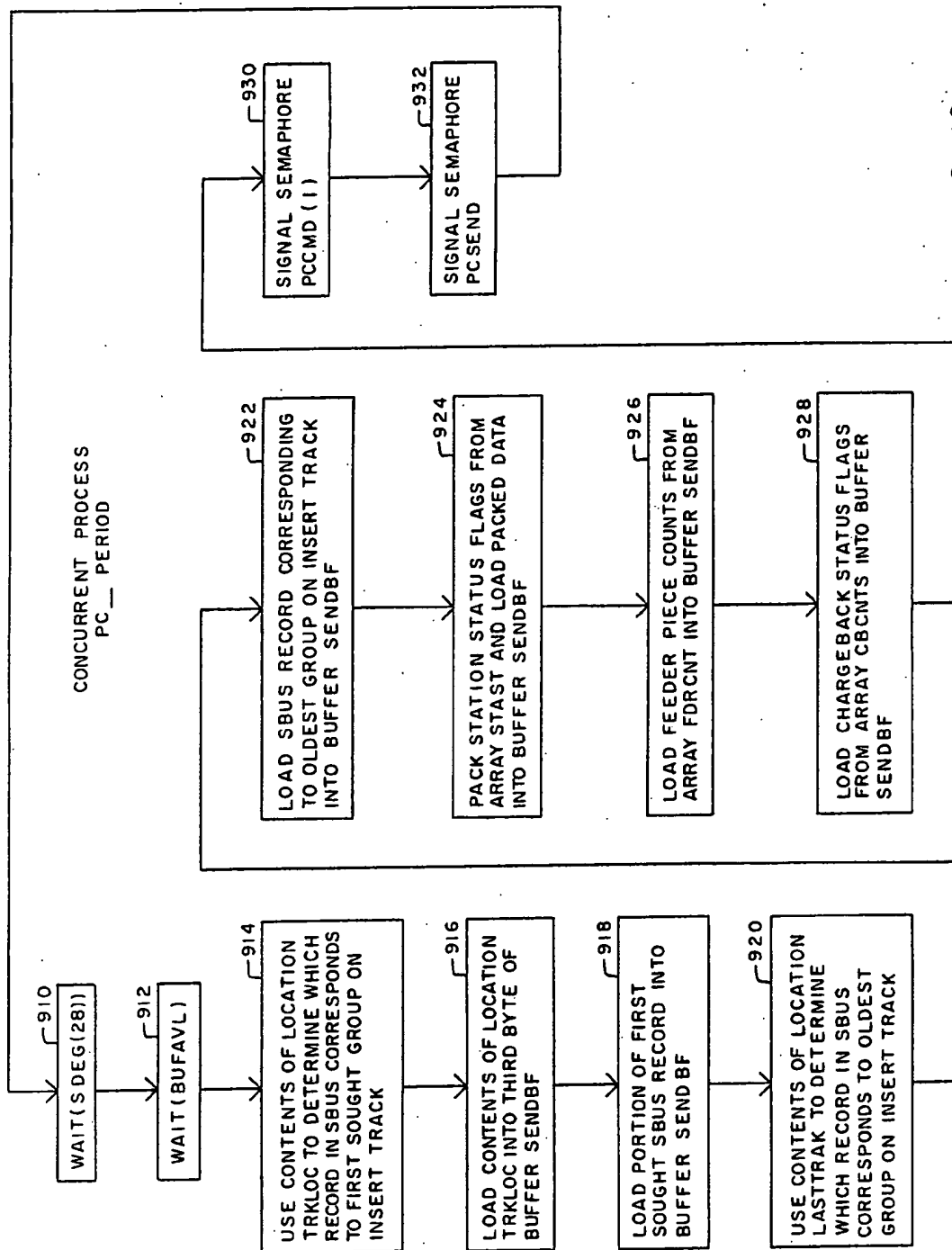


FIG. 18

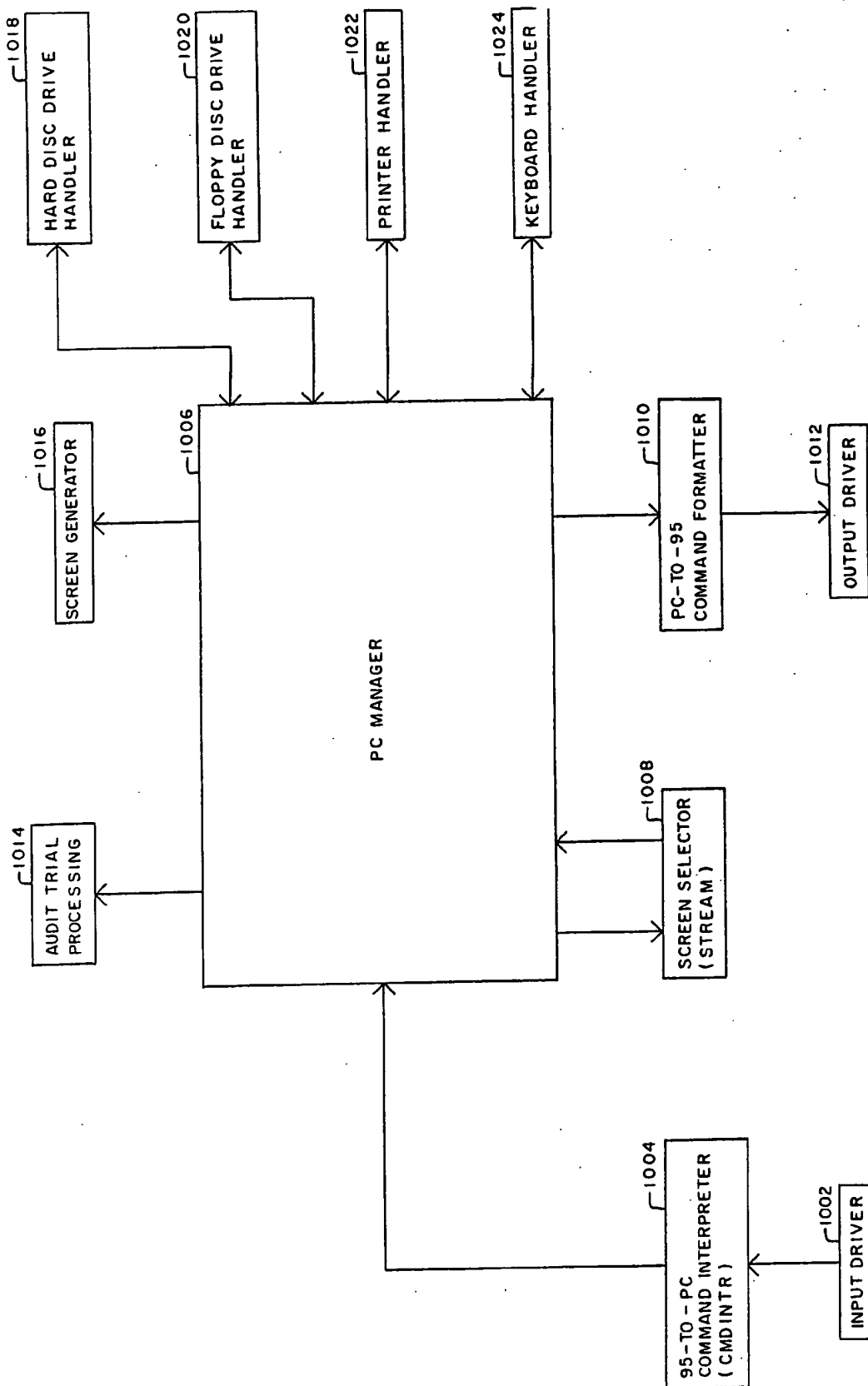


FIG. 19

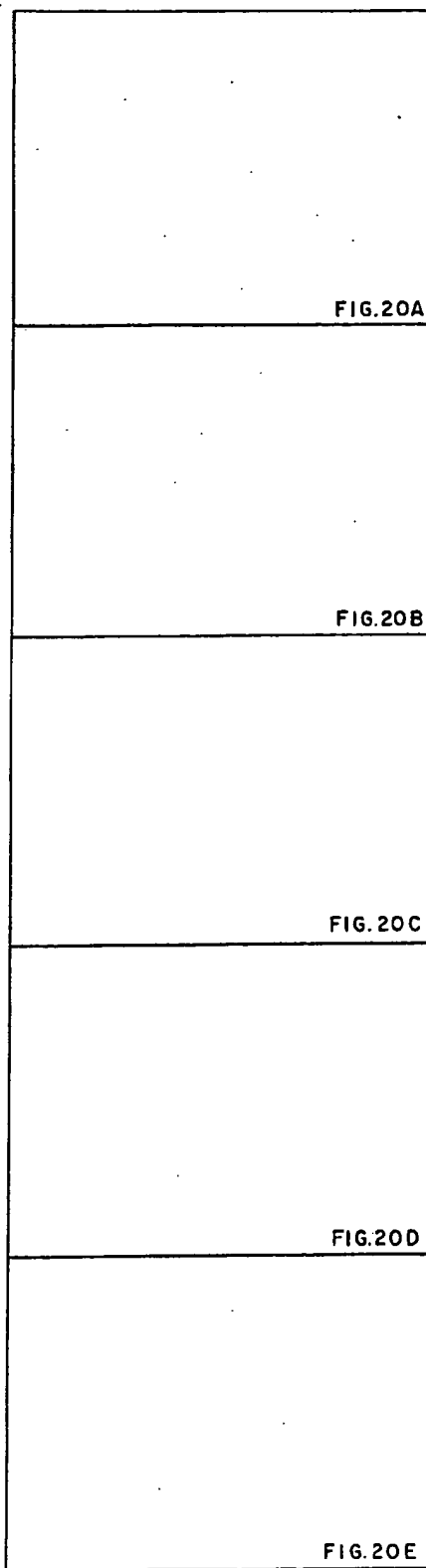


FIG. 20

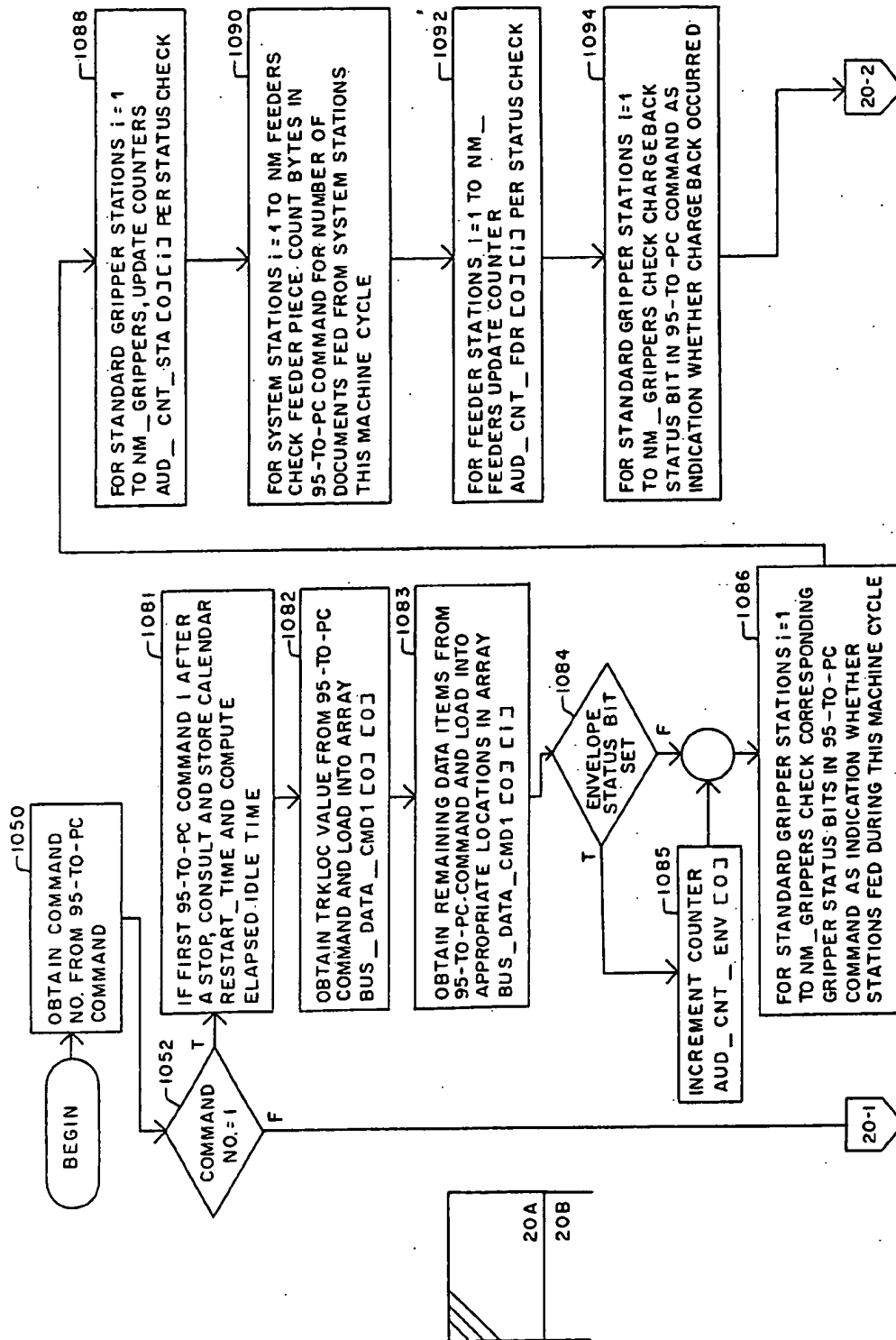


FIG. 20A SUBROUTINE CMDINTR

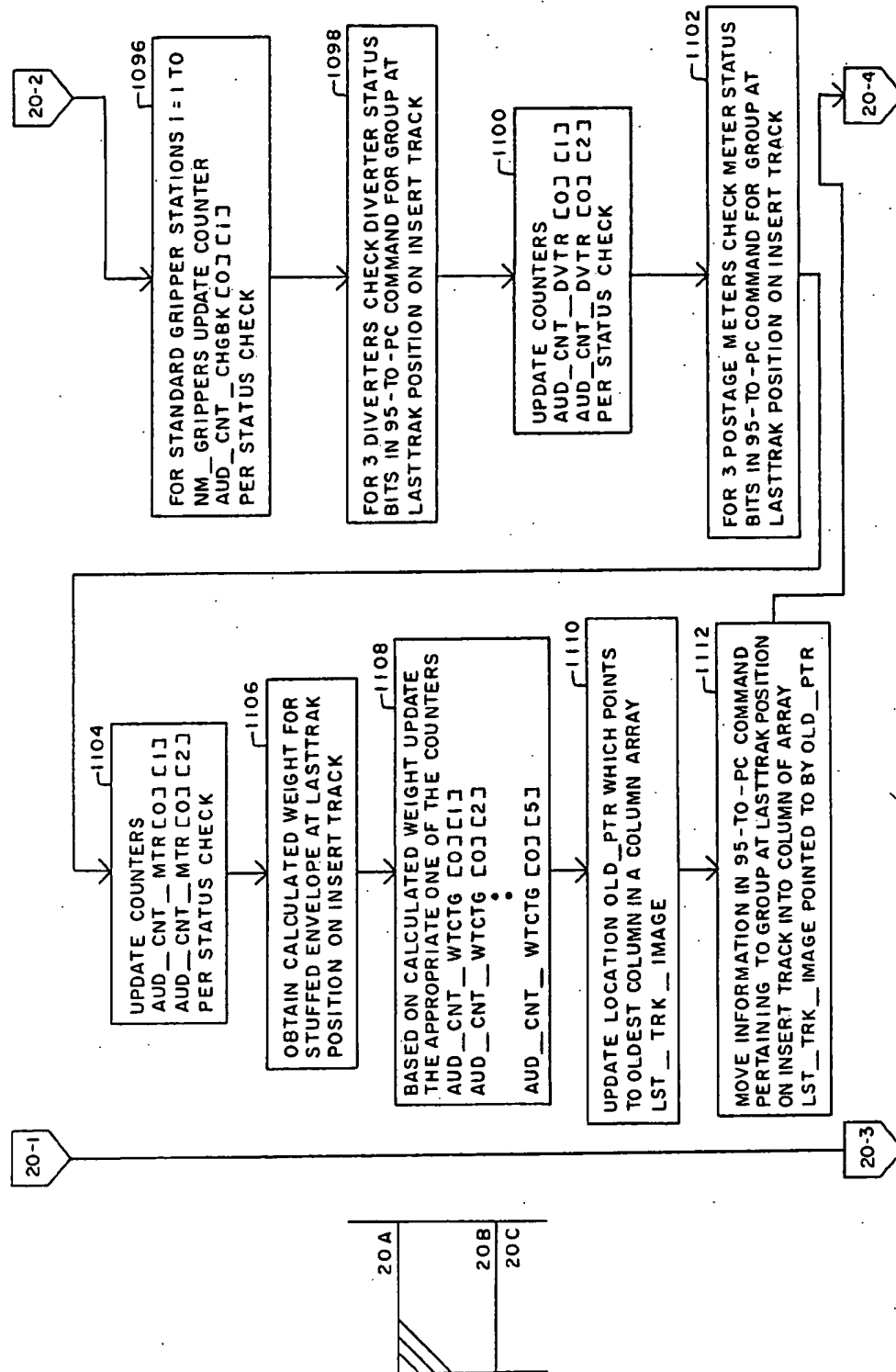


FIG. 20B

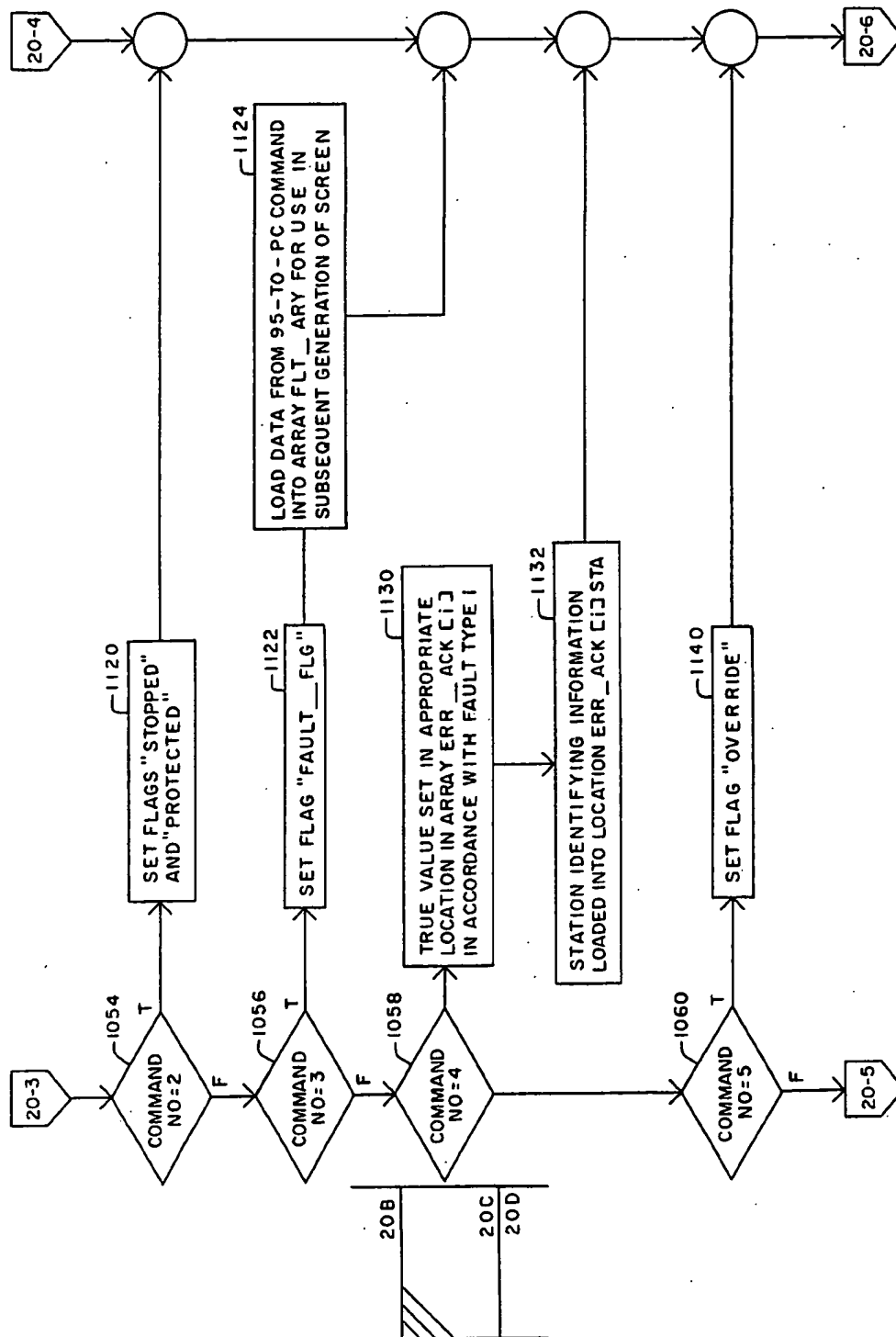
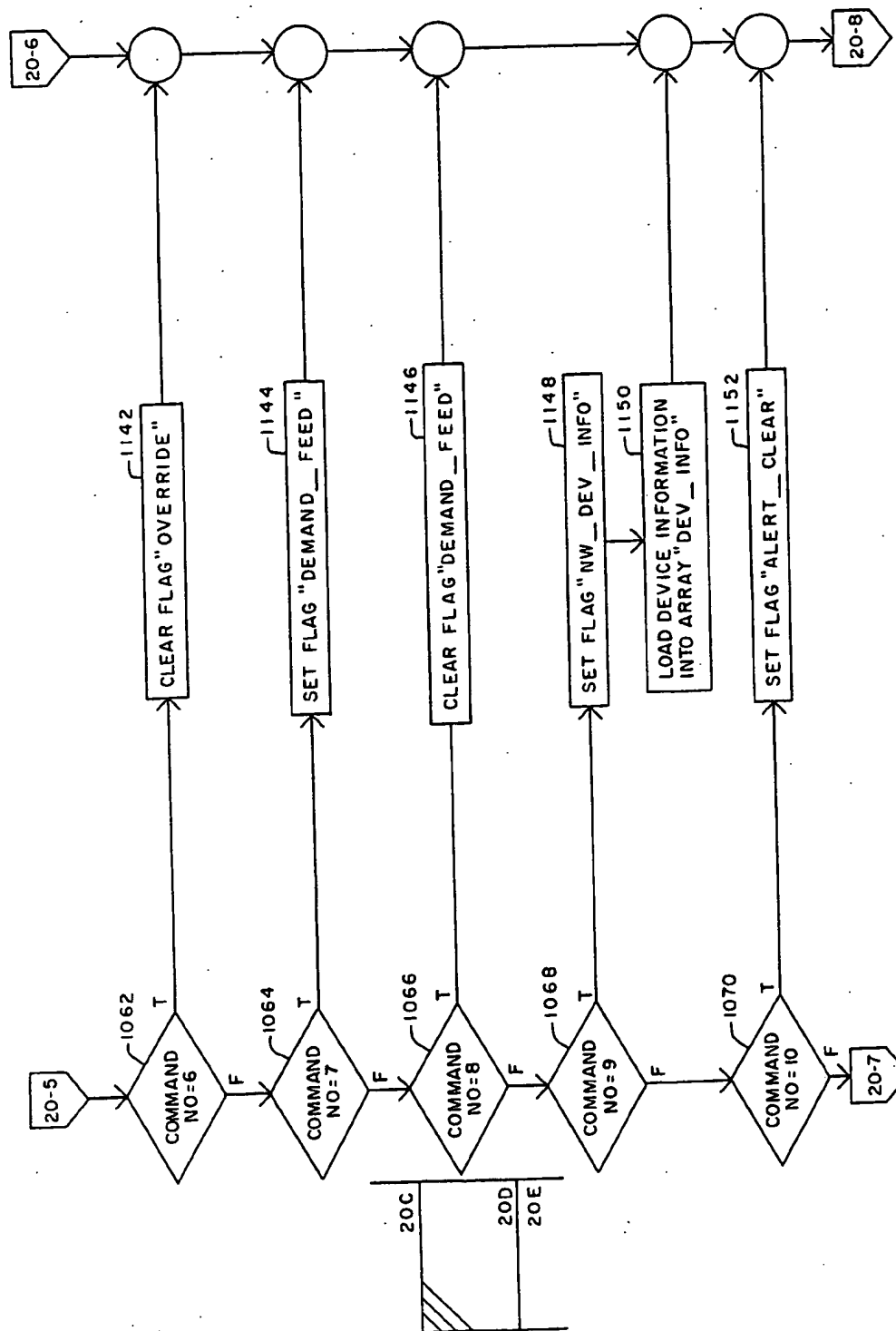


FIG. 20C



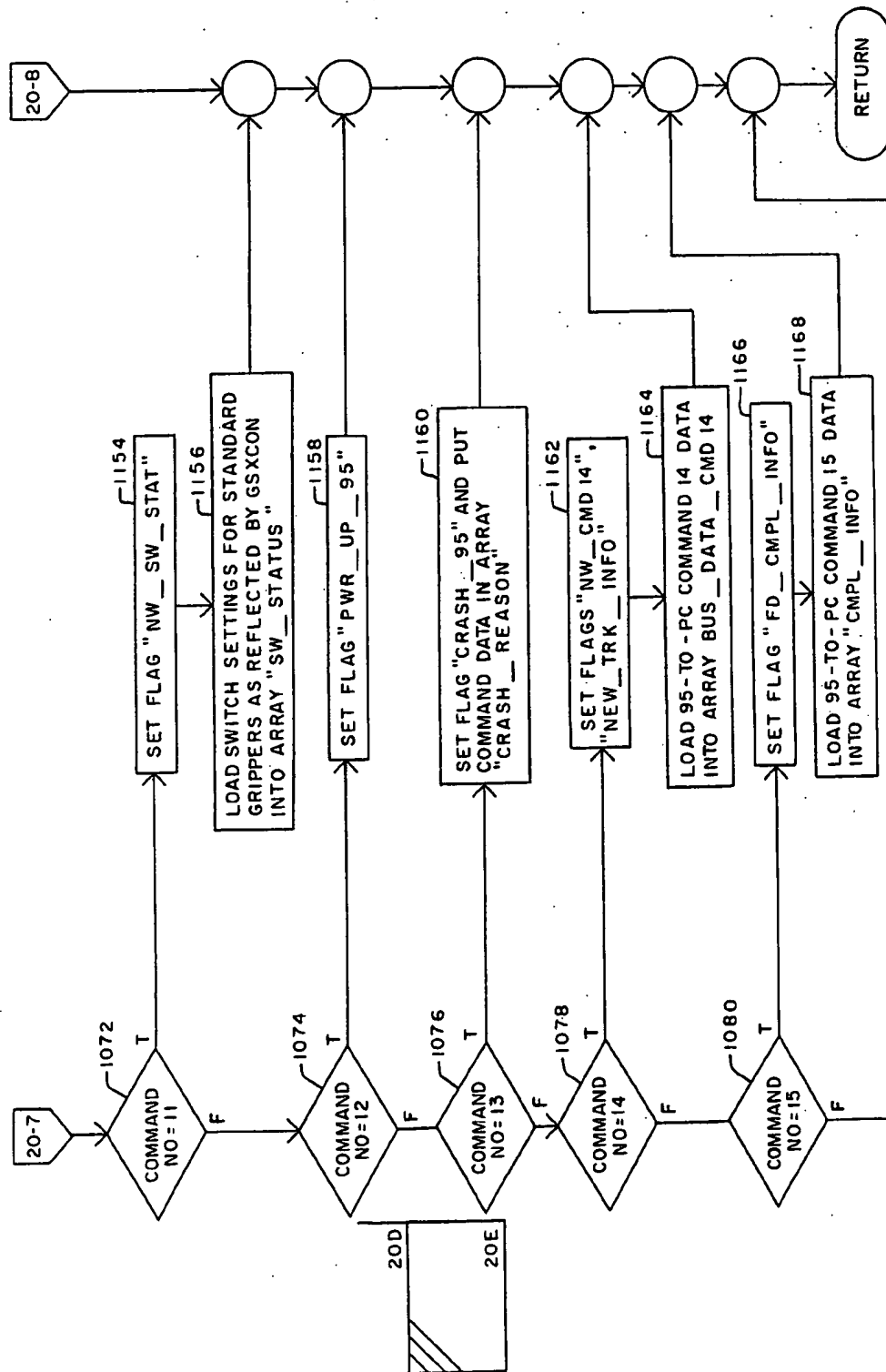


FIG. 20E

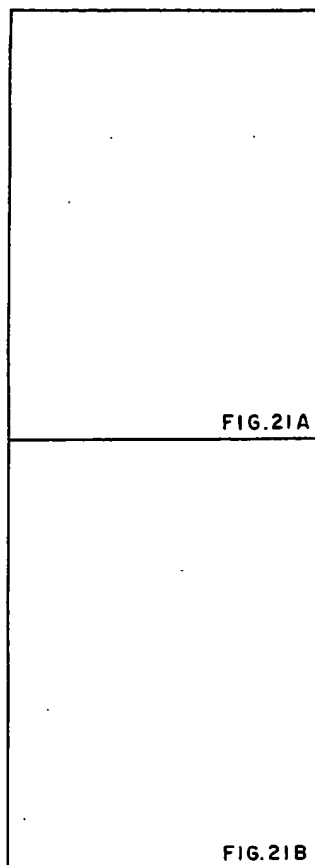


FIG. 21

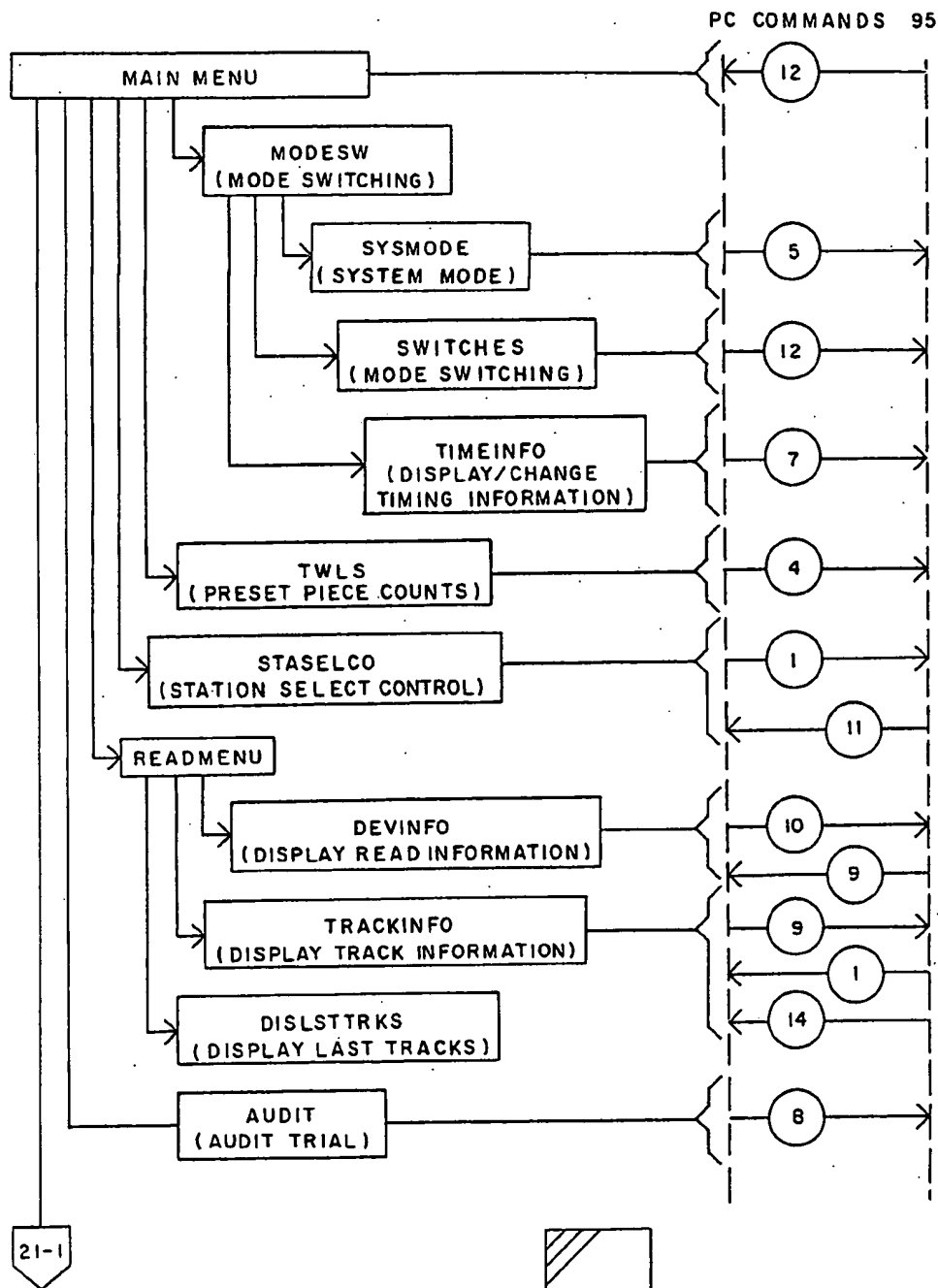
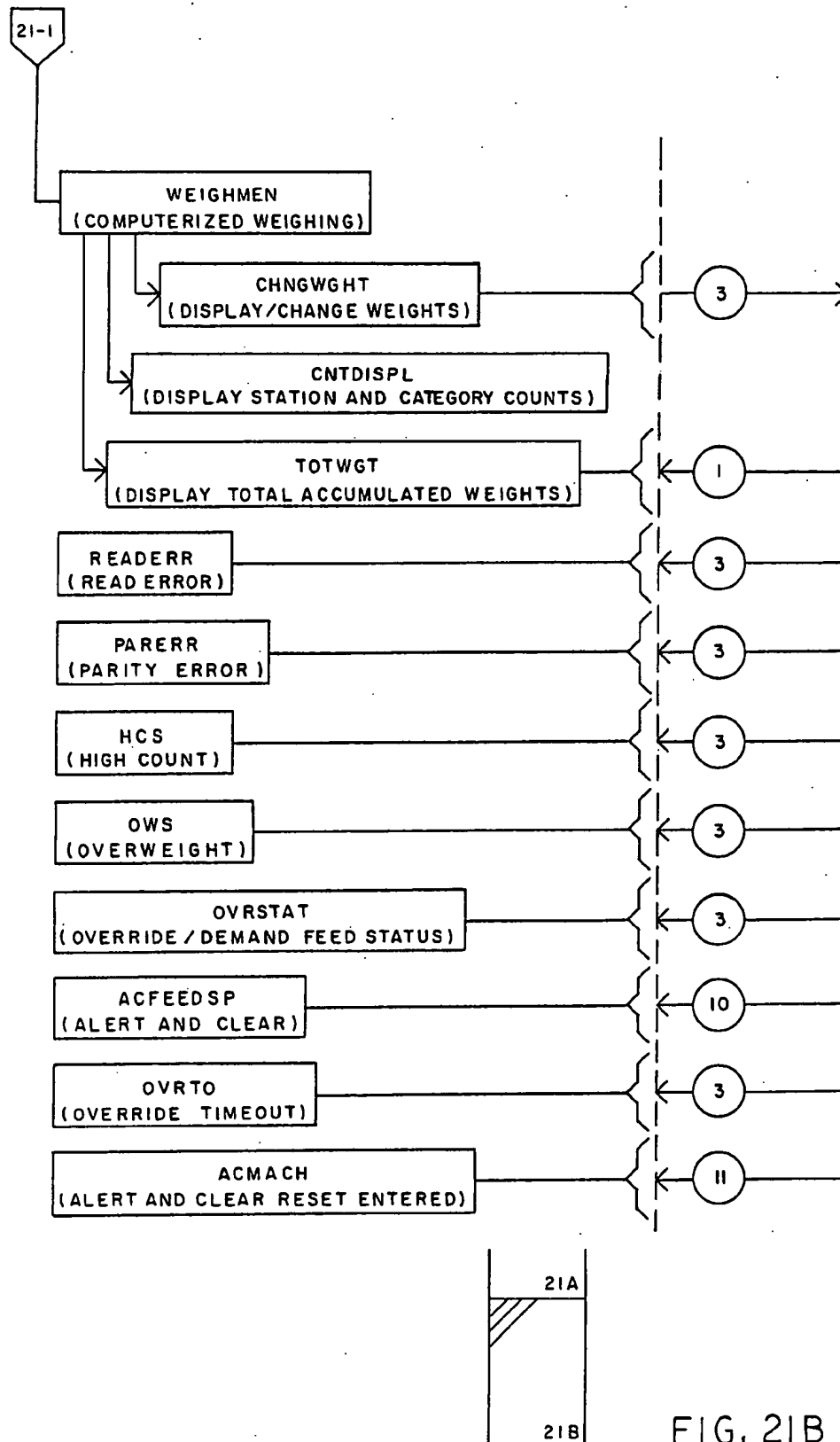
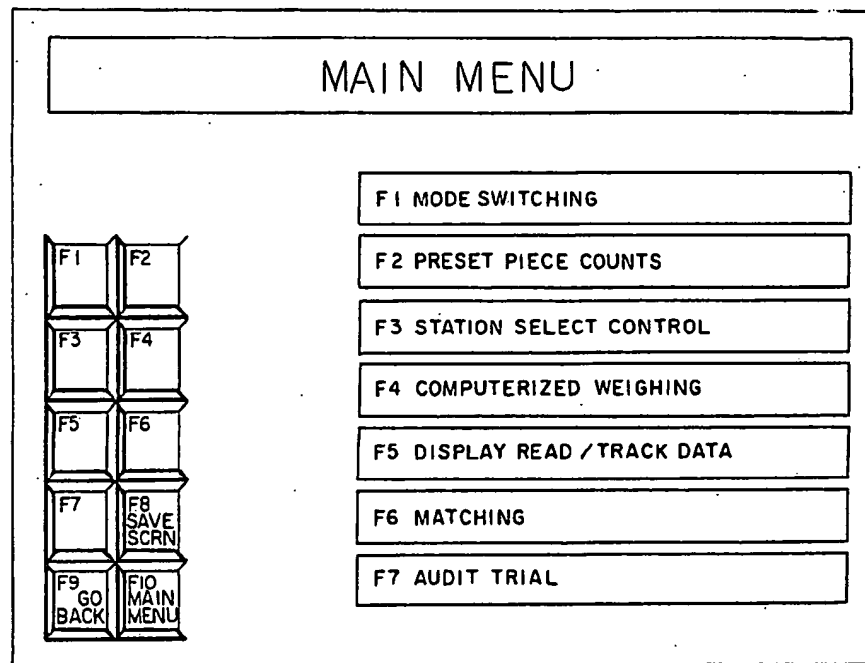
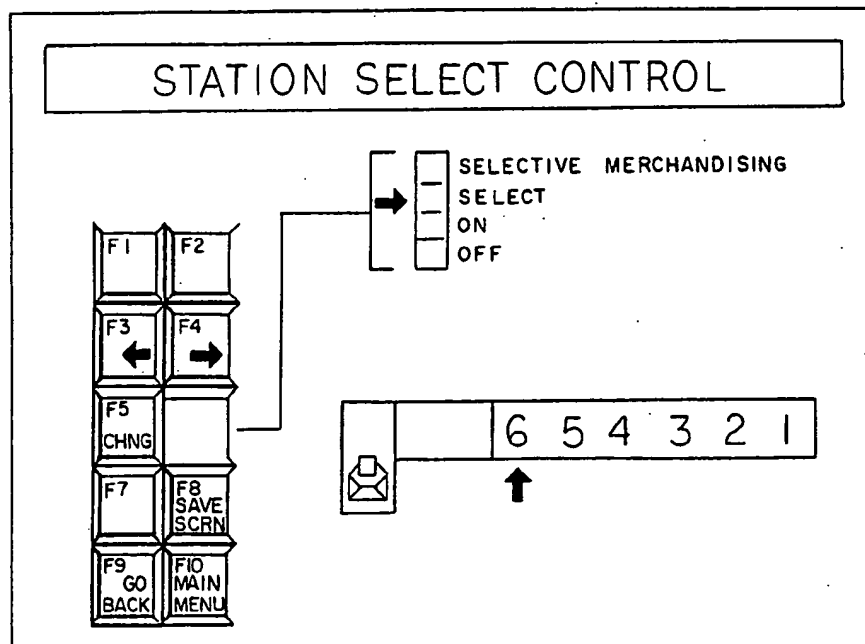


FIG. 21A

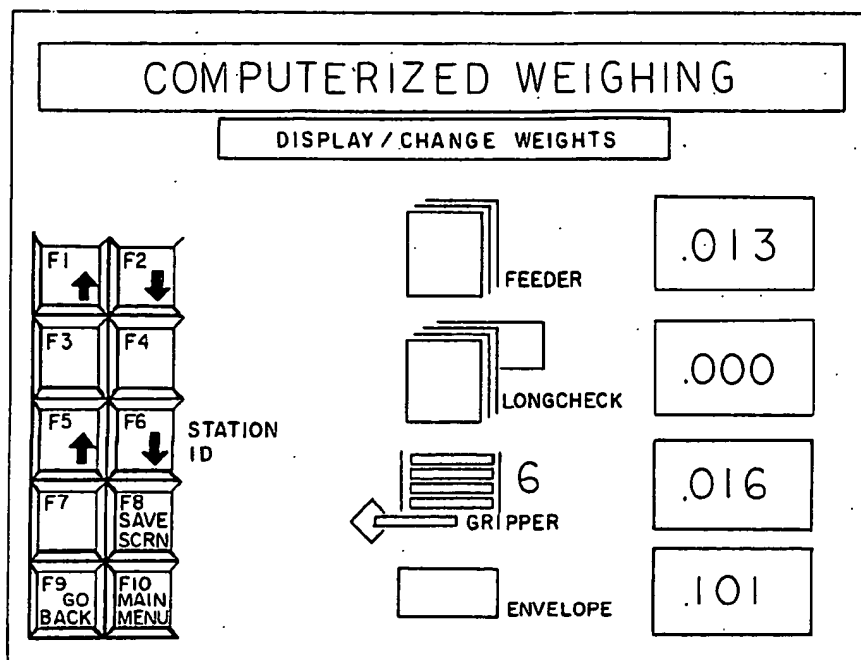




"MAINMENU"
FIG. 22A

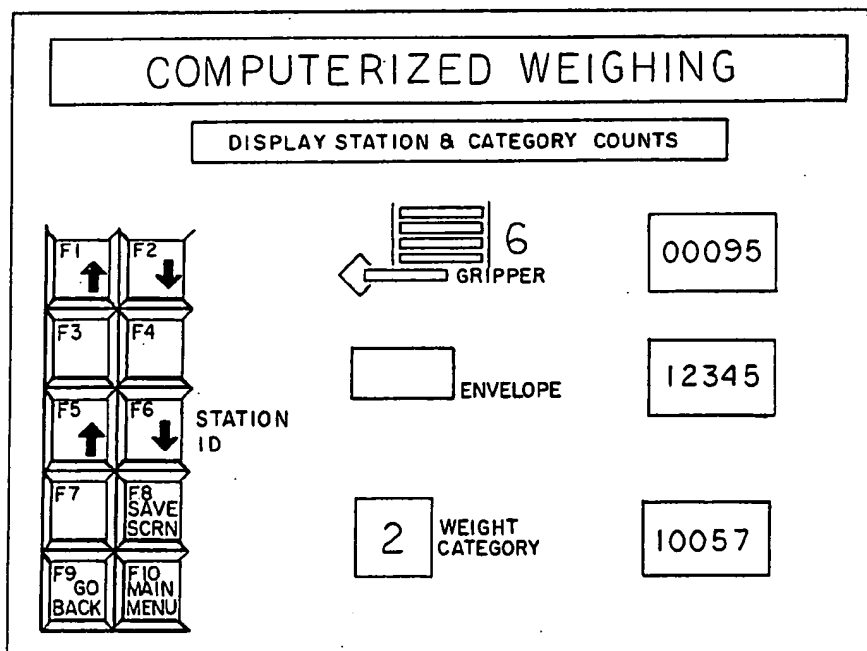


"STASELCO"
FIG. 22B



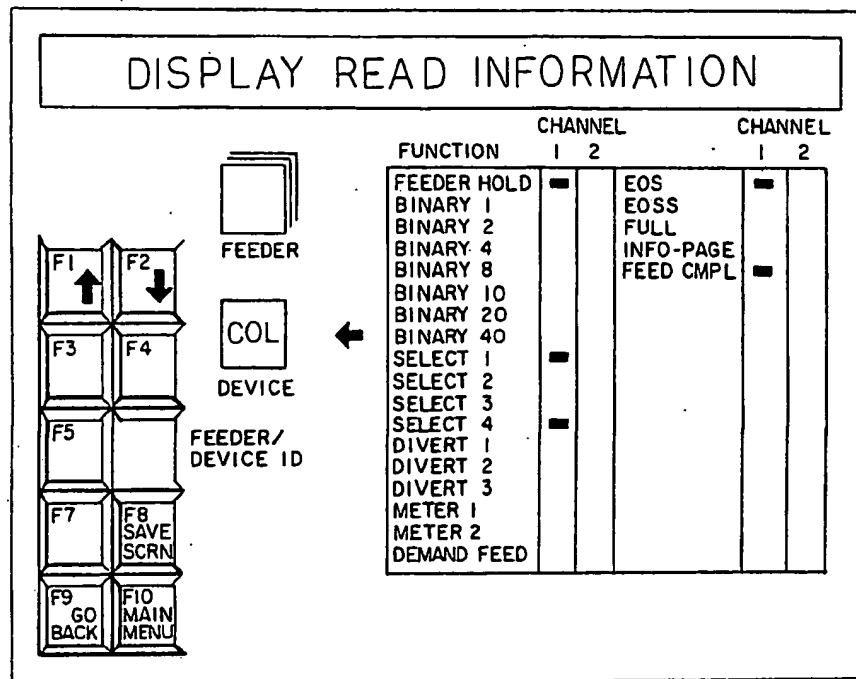
"CHNGWGHT"

FIG. 22 C



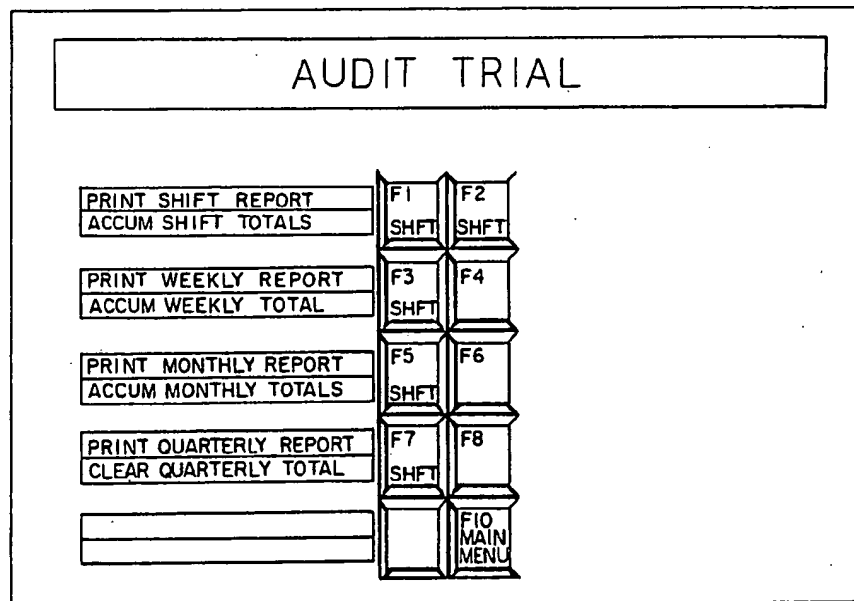
"CNTDISPL"

FIG. 22 D



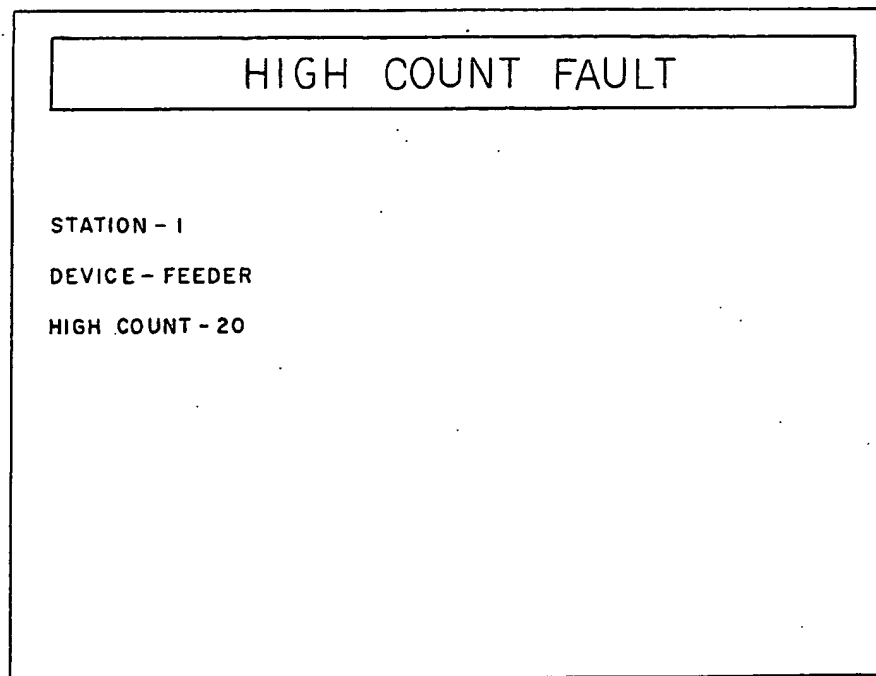
"DEVINFO"

FIG. 22E



"AUDIT"

FIG. 22F



"HCS"

FIG. 22 G

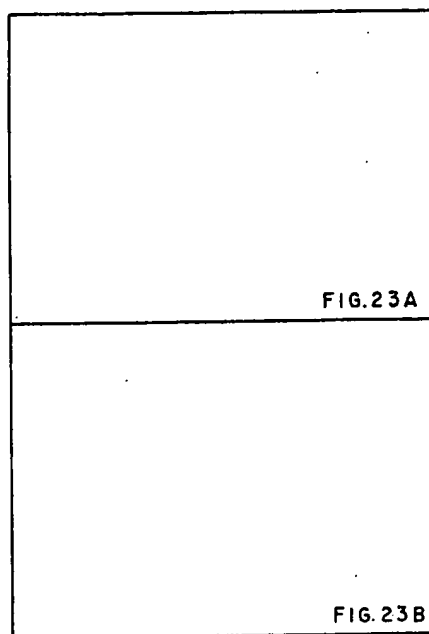


FIG. 23

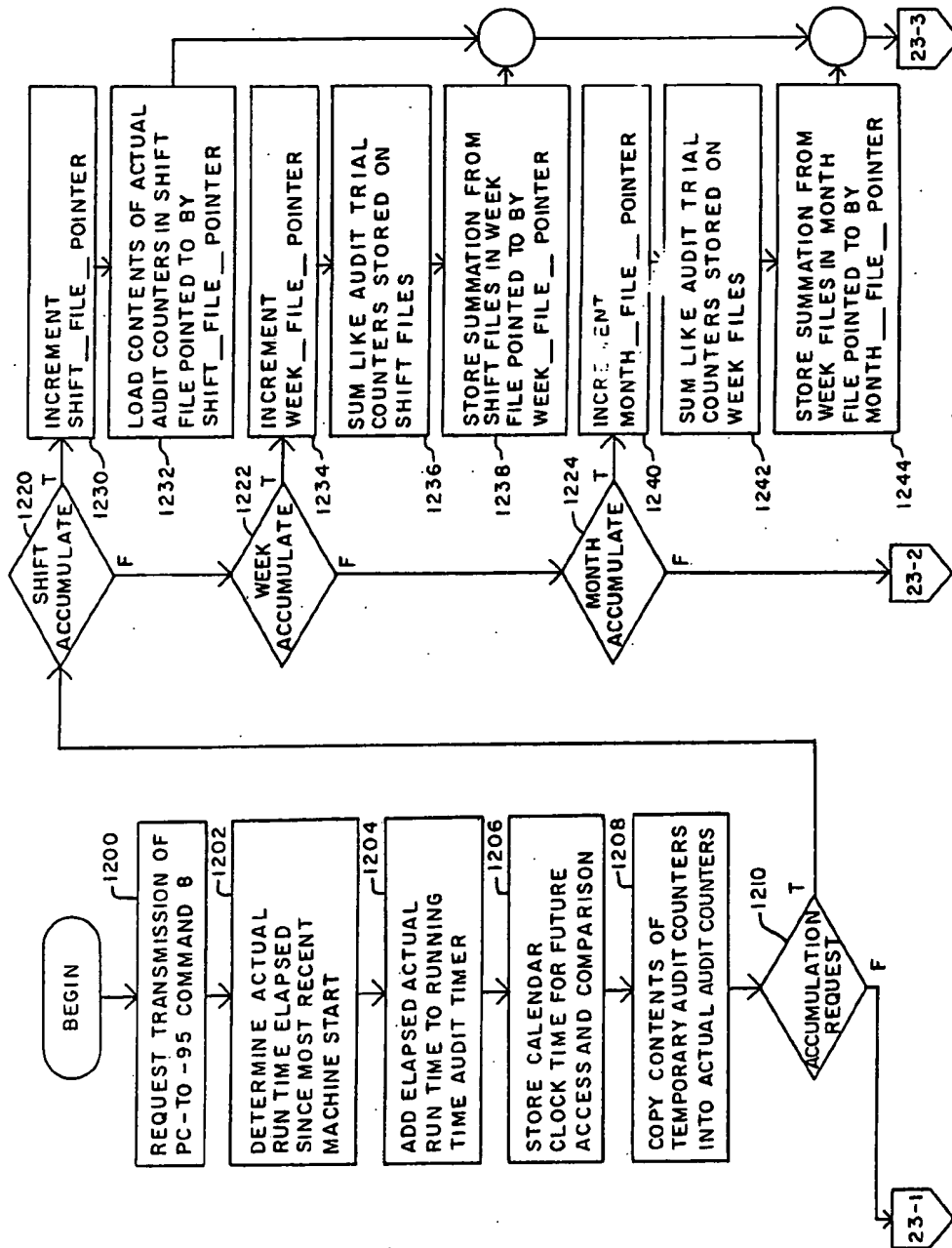
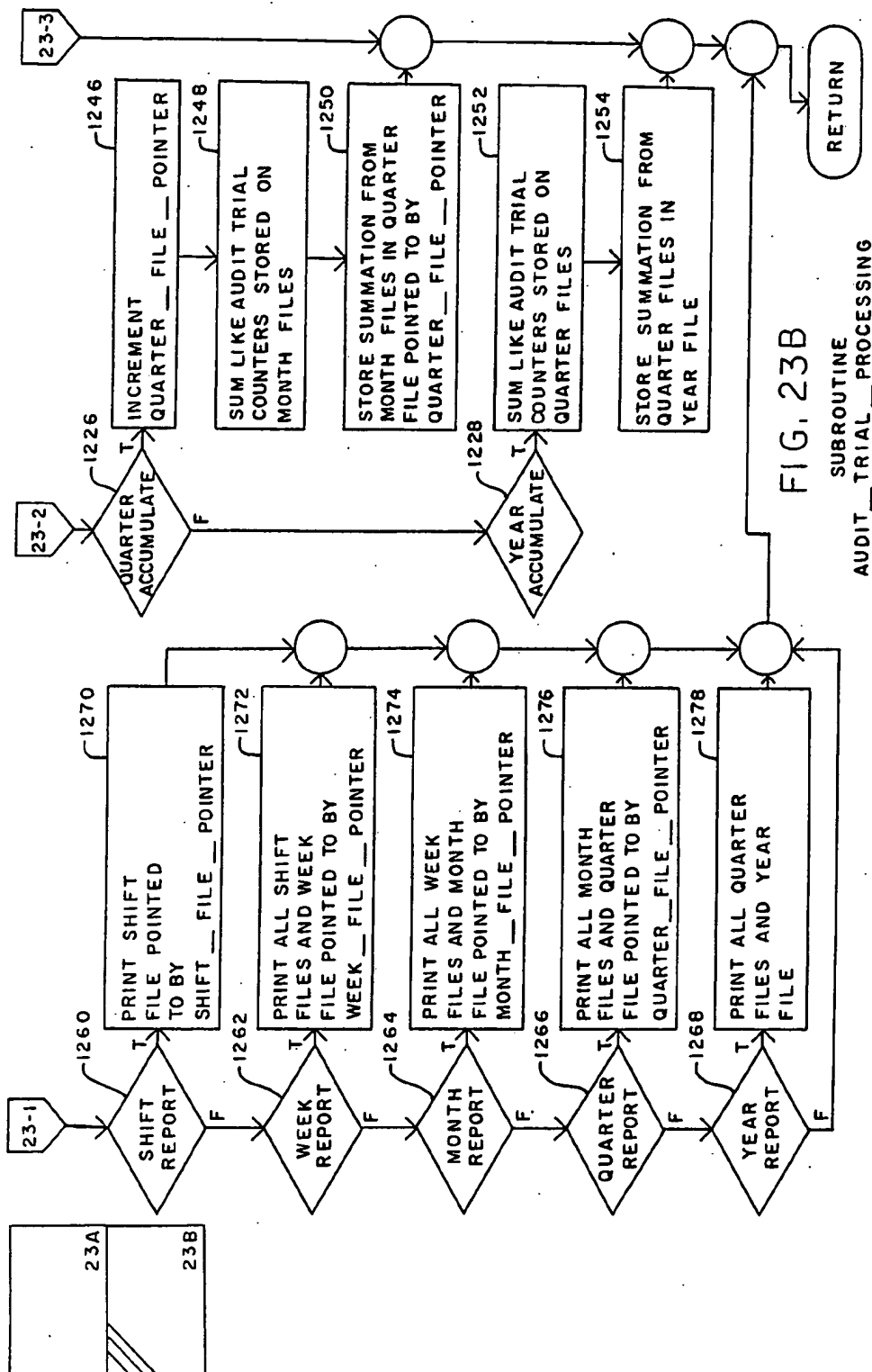


FIG. 23A

SUBROUTINE
AUDIT_TRIAL_PROCESSING



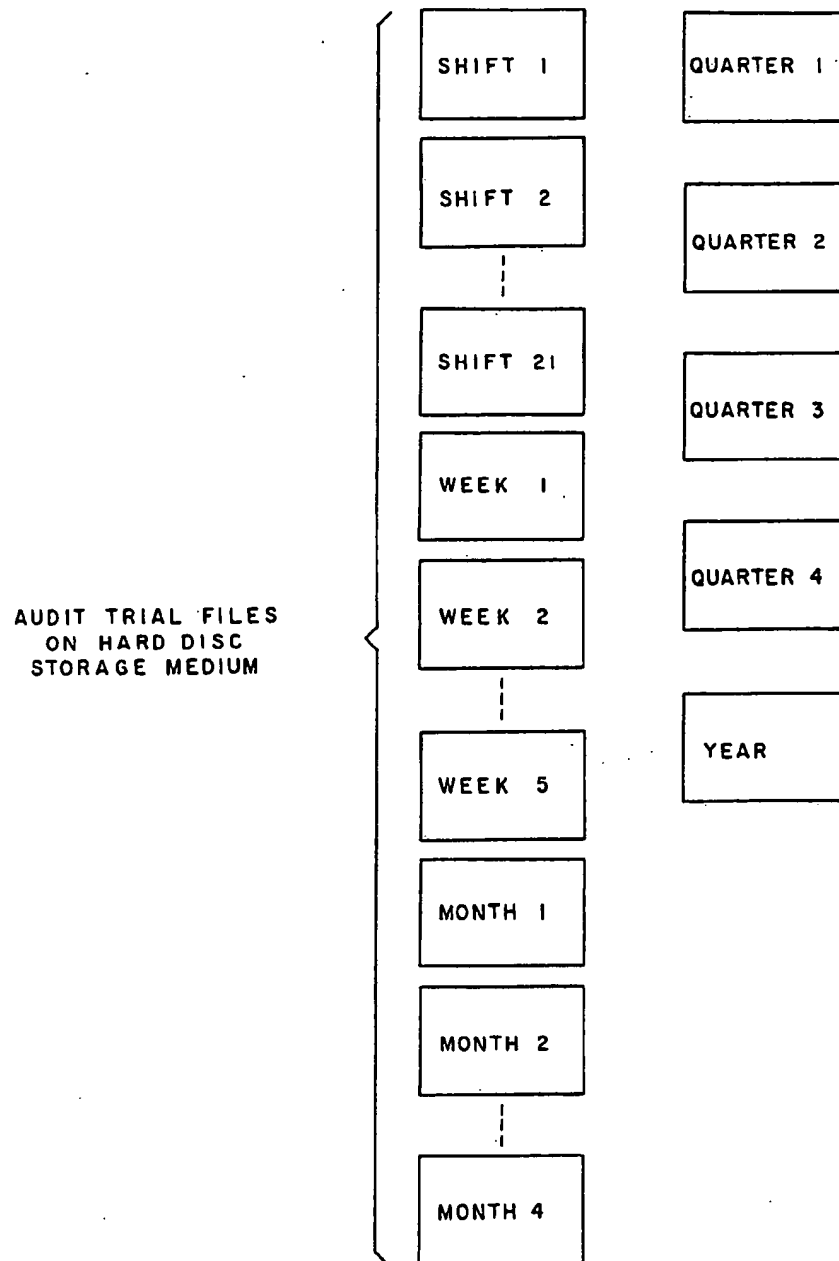


FIG. 24

INSERTION MACHINE WITH AUDIT TRAIL AND COMMAND PROTOCOL

This application is a continuation-in-part of U.S. patent application Ser. No. 823,427 filed Jan. 28, 1986 abandoned.

BACKGROUND OF THE INVENTION

I. Field of the Invention

This invention pertains to collating machines of the type which are operable as insertion machines, and particularly to methods and apparatus of monitoring the operation and performance of such machines.

II. Prior Art and Other Considerations

For several decades now collating machines have been utilized by commercial establishments for the preparation of printed matter for postal purposes. An early collating machine operated as an insertion machine is described in U.S. Pat. No. 2,325,455 to A. H. Williams.

In conventional collating machines, a plurality of processing stations perform processing events with respect to groups of documents being conveyed on an insert track in timed relation to a machine cycle. In most such machines the first such processing station positioned along the insert track is generally a first or control insert station which comprises feeder means for feeding inserts or documents onto the insert track. The insert track is generally indexed relative to further document feeding stations at a rate approximating one station or one track location position per machine cycle.

The document(s) deposited on the insert track from the first insert station is associated with a particular customer and typically bears a control indicia, such as a bar code printed thereon, which, when read, indicates with reference to the particular customer which further insert stations are to be actuated to feed one or more documents. As a particular customer's indicia-bearing document is indexed along the insert track, each insert station has an opportunity to feed (subject to operator control input and in accordance with the read control indicia) whatever document(s) stored thereat are applicable to the particular customer for inclusion with a group of documents related to the particular customer.

After all applicable inserts for a particular customer have been associated together as a group on the insert track, the associated documents are placed in an appropriate packaging medium at a packaging station. For collating machines which serve as insertion machines the packaging station is an inserting or stuffing station whereat the associated documents are stuffed into an awaiting envelope. Further operations such as envelope sealing, envelope diverting, and/or zip code grouping occur yet downstream in accordance with some embodiments of insertion machines. In some collating machines a wrapper or the like is formed about or envelops the associated documents at the packaging station.

Some more recent collating machines are operated at least to some degree in conjunction with a computer or data processing system. In such machines the data processing system makes various decision relating to processing events, including decisions regarding the selective feeding of documents from various stations. In machines such as that described in U.S. Pat. No. 4,571,925 the data processing system even makes a determination relative to postal allocation for a group in accordance with a projected group weight which is

calculated by the data processing system on the basis of the per document weights of documents stored at the feeding stations. Some document insertion machines have data processing systems wherein the central processing unit which manages the insertion machine also manages a display device such as cathode ray tubes whereupon textual indications of machine diagnostic information, such as machine jams, for example, are displayed.

Numerous collating machine operating parameters must be established prior to the processing of a job or batch. Some of the operating parameters have been established by manually setting certain mechanical switches; others of the operating parameters have been establishing by manually entering data related to the parameters into the data processing system through a plurality of electronic switches or keyboards. On some occasions human operators have overlooked the setting of one or more input parameters with the result that a portion of the batch or run may not be properly processed.

According to prior art practice, in order to prepare a collating machine to process a job or batch, an operator had to first provide (via both a system panel and a machine control panel) certain operating parameters indicative of which of the insert stations included in the particular collating machine configuration are to be turned OFF, which are to be turned ON; and, for some embodiments, which are in a SELECT mode. If an insert station were OFF, the insert station was not permitted to feed a document regardless of a customer's control indicia. If an insert station were ON, the insert station was required to feed a document regardless of a customer's control indicia. If an insert station were specified as being in a SELECT mode, the control indicia was used to determine whether the insert station was to feed.

The efficiency of an insertion machine depends upon several factors, including the machine cycle speed and the average number of documents per customer fed from the control station. In this respect, if the machine is operating at too fast a speed, for many customers feeder stations may not be able to feed and/or collect within a single machine cycle all the documents to be fed therefrom. For example, in an insertion machine which employs a burster with a collector, for a customer with many documents several machine cycles may be required before all the customer's documents are collected and ready for deposit on the insert track. As a result, several sections of the insert track are left empty during the delay. As another example, in an insertion machine which employs a fast feeder such as a check feeder, for a customer with many documents the insert track will have to remain stationary for one or more machine cycles. In both cases the efficiency of the insertion machine is reduced. Thus, it would be helpful for an operator to know the average machine cycle speed, the average number of documents per customer being fed from a control station, and the relationship therebetween so that the machine cycle speed can be set at an optimum level.

In addition to the foregoing, it would be beneficial to provide a statistical report of other operations performed by an insertion machine. Accurate statistical reports would facilitate better stocking of hoppers associated with insert stations; would provide more detailed diagnostic information for maintenance and servicing purposes; and, would provide tangible records for man-

agement purposes of operator performance and machine production.

In view of the foregoing, it is an object of this invention to provide an insertion machine and operating method therefor in which machine operations are monitored and a statistical report thereof is provided.

An advantage of the present invention is the provision of an insertion machine and operating method therefor which monitors its own operations and reports statistical data which is useful for operating the machine more efficiently.

Another advantage of the present invention is the provision of an insertion machine and operating method therefor which monitors its own operation and reports statistical data which is useful for diagnosing potential machine problems.

Yet another advantage of the present invention is the provision of an insertion machine and operating method therefor which monitors its operation and reports useful accounting information.

Still another advantage of the present invention is the provision of an insertion machine and operating method therefor which facilitates a systematic and orderly establishment of machine operating parameters.

SUMMARY

Processing events of an insertion machine are managed by a first data processor (DPS1). The DPS is connected to a second data processor (DPS2) by a data transmission cable whereby the DPS1 sends data formatted in accordance with a plurality of 95-TO-PC COMMANDS to the DPS2 and whereby the DPS2 sends data formatted in accordance with a plurality of PC-TO-95 COMMANDS to the DPS1. The DPS2 has associated therewith data storage medium drive mechanisms and peripheral devices including a display monitor, a keyboard, and a printer.

Some of the PC-TO-95 COMMANDS are used for downloading values for insertion machine input parameters and are generated in response to user input via keyboard as prompted by appropriate displays on the monitor. Other PC-TO-95 COMMANDS are generated in response to user input for interrogating the DPS1 and prompt the DPS1 to generate an answering 95-TO-PC COMMAND which includes insertion machine-related operating output data. Other 95-TO-PC COMMANDS including insertion machine-related operating data are generated in dependence upon insertion machine activity, such as the reaching of a certain point in the machine cycle or the detection of a machine fault. As prompted by a display on the monitor the user can cause the DPS2 to generate a command which stops the insertion machine and to enter an AUDIT TRAIL mode. In the AUDIT TRAIL MODE the DPS2 generates a statistical report regarding monitored operations of the insertion machine in accordance with analysis by the DPS2 of the insertion machine-related operating output data which has been periodically sent to the DPS2.

Various operations associated with an insertion machine are monitored in connection with the statistical report over a plurality of time bases or time frames. Monitored operations include the number of inserts fed from each of a plurality of insert stations; the number of envelopes diverted by each of a plurality of stackers; the number of envelopes metered by each of a plurality of postage meters; the number of envelopes completed; the number and type of machine stops or faults; the actual

machine run and idle times; and, the average machine cycle speed per hour.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the various views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

FIG. 1 is a perspective view of an insertion machine according to a first embodiment of the invention;

FIG. 1A is a perspective view of an insertion machine according to a second embodiment of the invention;

FIG. 2A is a side view of machine cycle detection means according to the embodiments of FIGS. 1 and 1A;

FIGS. 2B and 2C are front and rear views, respectively, of machine cycle detection means according to the embodiments of FIGS. 1 and 1A;

FIG. 3 is a schematic diagram of machine cycle detection circuitry according to embodiments of FIGS. 1 and 1A;

FIG. 4 is a chart which illustrates the format of portions of a system global data bus SBUS according to the embodiments of FIGS. 1 and 1A;

FIG. 5 illustrates a plurality of audit counters and timers included in a non-volatile memory associated with a data processing system according to the embodiments of FIG. 1;

FIG. 5A illustrates locations included in a memory associated with the data processing system according to the embodiment of FIG. 1 wherein average values are stored;

FIG. 6 is a front view of an operator console according to the embodiment of FIG. 1;

FIG. 7 is a schematic diagram showing the relationship of FIGS. 7A, 7B, 7C, and 7D

FIGS. 7A, 7B, 7C, and 7D are schematic diagrams illustrating processing operations involved in a calculation made of a concurrent program CW for the embodiment of FIG. 1;

FIG. 8 is a schematic diagram showing logic steps involved in a diversion determination and report according to the embodiment of FIG. 1;

FIG. 9 is a schematic diagram illustrating processing operations involved in a concurrent program STOP INTERRUPT for the embodiment of FIG. 2;

FIG. 10 is a schematic diagram showing processing operations involved in a concurrent program REPORT GENERATION for the embodiment of FIG. 1;

FIG. 11 is a chart showing an AUDIT TRAIL report generated format according to the embodiment of FIG. 1;

FIG. 12 is a schematic diagram illustrating processing steps involved in accumulating and updating audit counters and audit timers for the embodiment of FIG. 1;

FIG. 13 is a schematic diagram illustrating a second data processing means and related peripheral devices associated with a collating machine serving as an insertion machine according to the embodiment of FIG. 1A;

FIG. 14 is a schematic diagram showing various programs, processes, and procedures included in the customized software system for the embodiment of FIG. 1A which signal a semaphore PCSEND in connection with the generation of 95-TO-PC COMMANDS;

FIG. 15 is a schematic diagram illustrating execution operations associated with a concurrent program IB_M_PC;

FIG. 16 is a schematic diagram illustrating the relationship of FIGS. 16A, 16B, and 16C;

FIGS. 16A, 16B, and 16C are schematic diagrams illustrating execution operations associated with a concurrent process PC_INT;

FIG. 17 is a schematic diagram illustrating the relationship of FIGS. 17A and 17B;

FIGS. 17A and 17B are schematic diagrams illustrating execution operations associated with a concurrent process PC₁₃ OPR;

FIG. 18 is a schematic diagram illustrating execution operations associated with a concurrent process PC_PERIOD;

FIG. 19 is a schematic diagram illustrating the interrelationship between a program PC Manager and sub-routines executed by the second data processing means of the embodiment of FIG. 1A;

FIG. 20 is a schematic diagram illustrating the relationship of FIGS. 20A, 20B, 20C, and 20D;

FIGS. 20A, 20B, 20C, and 20D are schematic diagrams illustrating execution operations associated with a subroutine CMDINTR of the embodiment of FIG. 1A;

FIG. 21 is a schematic diagram illustrating the relationship of FIGS. 21A and 21B;

FIGS. 21A and 21B are schematic diagrams illustrating the interrelationships between screen displays displayable on a monitor, as well as the 95-TO-PC COMMANDS which prompt generation of the screen displays and/or the PC-TO-95 COMMANDS generated in response to keyboard input prompted by the screen displays;

FIGS. 22A through 22G are front views of differing screen displays displayable on display monitor means of the embodiment of FIG. 1A;

FIG. 23 is a schematic diagram showing the relationship between FIGS. 23A and 23B;

FIGS. 23A and 23B are schematic diagrams illustrating execution operations associated with a subroutine AUDIT_TRAIL_PROCESSING of the embodiment of FIG. 1A; and,

FIG. 24 is a schematic diagram depicting various files included on a hard disc storage medium associated with the embodiment of FIG. 1A.

DETAILED DESCRIPTION OF THE DRAWINGS

First Embodiment Structure

FIG. 1 illustrates an insertion machine according to a first embodiment of the invention. The embodiment of FIG. 1 comprises a back table portion 26 and a front table portion 28. The back table portion 26 includes an essentially linearly-extending insert track 30 which extends along a series of insert processing stations. The insert track 30 has sets of pusher pins P formed on an indexing chain 31 whereby the insert track 30 conveys groups of documents deposited thereon in the direction of arrow 40 from an upstream-most insert station 42 to an insertion or envelope stuffing station 44.

The insert track 30 is indexed once per machine cycle in a manner well known in the prior art. In this respect, it is understood that the entire insertion machine is driven by an unillustrated motor. The motor is coupled both to a continuously rotating main timing shaft and to an intermittently rotating shaft. One full rotation (i.e.

360°) of the continuously rotating main timing shaft is referred to as a machine cycle. The indexing chain 31 is suitably connected to the intermittently rotating shaft by means well known to those skilled in the art whereby the chain 31 is moved during a portion of the machine cycle. In the embodiment described herein, the chain is essentially stationary through 0 to 180 degrees of the machine cycle (DMC) and moves essentially from 180 DMC to 360 DMC for incrementally advancing documents. It should be understood, however, that the particular degree of machine cycle at which chain 31 moves differs in some embodiments in view of various acceleration and deceleration factors.

An envelope track 45 extends on the front table portion 28 in parallel manner along-side at least a portion of the insert track 30. The envelope track 45 has gripping jaws 46 formed on an indexing chain 48 whereby the envelope track 45 pulls an envelope deposited thereon also in the direction of arrow 40 away from an envelope feed processing station 50 and toward the insertion station 44. The front table portion 28 has associated therewith a continuously rotating timing shaft and an intermittently rotating shaft. In differing embodiments these two shafts associated with the front table portion 28 are coupled directly to the machine motor as described above or are mechanically linked to the continuously rotating main timing shaft and to the intermittently rotating shaft described above which operates chain 31. The intermittently rotating shaft associated with the front table portion 28 is used to incrementally advance the envelope indexing chain 48.

The series of insert processing station includes the first or up-stream most insert station 42, as well as the second, third, fourth, fifth, sixth and seventh insert stations numbered 52 through 57, respectively. The first insert station 42 is a cutter-type insert station which includes a web cutter of the type marketed by the FIMA Corporation. The insert station 42 cuts documents from a web of documents; collects the cut documents in sub-groups in a collection stage; and, discharges sub-groups onto the insert track 30 generally at a rate of one sub-group per machine cycle. The first insert station 42 includes unillustrated reading means for reading indicia printed or otherwise formed on the customer's document. The indicia can be prepared to include indications of numerous types of information including, for example, whether the document is the first document in a sub-group; which of the remaining insert stations in the series 32 are to feed documents with respect to this customer; the number of documents to be fed from any of the insert stations included in the series 32 which are capable of feeding a plurality of documents per machine cycle; which of a possible plurality of downstream diversion mechanisms are to be actuated; which of a possible plurality of downstream envelope marker mechanisms are to be actuated (for such reasons as indicating the beginning of a new zip code set); and whether an envelope is to be sealed or unsealed.

A reading station such as insert station 42 of the embodiment of FIG. 1 can function in any of a plurality of modes. If the reading station is the upstream-most reading station in a particular insertion machine configuration, the insertion station is in a control mode and is known as a control station. At a control station various information indicated by the read indicia is stored in memory means for use in conjunction with downstream

processing. If the station has the capability to perform a match operation (i.e. to match the number of a plurality of documents which the station actually fed per machine cycle with the number required by the read indicia, or to match a printed pattern or the like on its fed document with a pattern characterizing the particular customer whose group was positioned before the station) and the match capability is utilized, the insertion station is in a match mode and is also known as a "matching" station.

In the configuration of FIG. 1, the insert station 42, being the upstream-most reading station, serves as a control station. Therefore indicia read at the insert station 42 is stored in memory for downstream processing.

The insert stations 52 through 57 are each standard gripper-type insert stations having oscillating gripper arm structure. In a gripper insert station, a gripper arm mounted on an oscillating shaft extending above the insert track oscillates the gripper arms toward and away from a hopper associated with the first insert station. The gripper arm has two jaw members which selectively engage a vacuum-deflected document in the insert station hopper at an appropriate point in the machine cycle and which, after the gripper arm has oscillated away from the hopper, selectively disengage the document, thereby depositing the document on the insert track. Insert stations can be classified as a "standard" insert station-type as just described or can be classified as a "reading" insert station-type by virtue of the further inclusion in their structure of appropriate indicia reading electronics. These standard gripper-type insert stations 52 through 57 do not have the capability to read indicia or patterns of documents fed therefrom, but merely feed documents in accordance with operator control input and the indicia read at the control station 42. Each standard gripper insert station 52-57 has associated therewith a mistake detector to determine whether the gripper arm has engaged a proper number of documents. For the embodiment shown in FIG. 1, gripper arms and the associated mistake detectors are of the type shown in U.S. patent application Ser. No. 06/648,399 filed on Sept. 7, 1984 by Zemke et al. and incorporated herein by reference.

Considering further the insertion machine of the embodiment of FIG. 1, it is seen that such a machine can be utilized inter alia by a client which is a credit card company. In this example the first insert station 42 feeds a "summary of account" document for each of a plurality of customers; the second insert station 52 has stored thereat a self-addressed envelope for each of the plurality of customers; the third insert station 53 has a plurality of general interest or "required" informational documents (such as a notice advising of a change in interest rates) which are to be mailed to all customers; the fourth and fifth insert stations 54,55 have stored in their respective hoppers "special" or conditional interest informational documents to be enclosed with the statements for selected or targeted customers (such as notices to delinquent customers in the hopper for the fourth insert station and notices to senior citizen customers in the hopper for the fifth insert station); and, the hoppers of the sixth and seventh insert stations 56,57 have stored therein third-party advertising documents which are includable in piggyback fashion with the customer's statement and enclosures.

In the example just described the third-party advertising station 56 is of a type known in the prior art and described in U.S. patent application Ser. No. 06/576,893

filed Feb. 3, 1984 by Baggarly et al. which includes third-party advertising documents with a customer's statement and enclosures if and only if inclusion of the third-party advertising documents will not increase the postage amount for the customer's group. The documents fed from station 56 are counted so that the third-party associated with station 56 can be charged for the inclusion at a specified per insert fee. The third-party associated with station 57, on the other hand, has specified that its third-party advertising documents are to be included in each customer's group regardless of the impact of inclusion upon the postage amount for the group. As seen hereinafter, if the extra weight of the third-party advertising documents fed from station 57 increases the total weight of a customer's group sufficiently for the group to be classified in the next greater postage weight category (thereby incurring an additional postage amount), the third-party associated with station 57 is charged for the additional postage amount thusly incurred.

The processing stations located along the envelope track 45 include the afore-mentioned envelope feed processing station (also known as the envelope hopper) 50 and an envelope flap opener processing station 62. The envelope feed processing station 50 can, in differing embodiments, include any one of a plurality of types of envelope feeding mechanisms. The envelope flap opener processing station 62 can also be one of several types, including either a rotating plough, butterfly-type opener illustrated for example in U.S. Pat. No. 3,583,124 to Morrison, or a traveling and rotating sucker cup-type opener as illustrated in U.S. Pat. No. 4,318,265 to Orsinger, for example.

The insertion station 44 serves to stuff a group of related documents into an awaiting, opened envelope. The insertion station 44 includes conventional mechanical structure such as that illustrated in U.S. Pat. No. 3,965,644 to Stocker, for example. At insertion station 44 the back pannel of an envelope is deflected slightly upwardly by one or more oscillating sucker cups positioned above the envelope. The group of documents is then ushered into the awaiting, thusly-opened envelope by oscillating pusher foot-type structure 66. The pusher foot 66 is mechanically linked to the main timing shaft of the insertion machine whereby the pusher foot 66 oscillates to usher documents at the rate of once per machine cycle.

A sealing processing station 68 is situated immediately after the insertion station 44. The sealing station 68 comprises a wettable brush 70 which moistens a gummy seal-portion of a moving envelope flap prior to the flap being rotated back to its closed position.

Downstream from the sealing station 68 is an envelope turnover processing station 72 which, in a manner well known in the prior art, during four sequential machine cycles flips an envelope from envelope track 45 into a front panel-up orientation on an exit conveyor 73. The mechanical mechanism which performs the turnover or flip operation is mechanically linked to the machine timing shaft.

The exit conveyor of the embodiment of FIG. 1 comprises a first segment 73A and a second segment 73B. Segment 73A, which extends beneath two diversion processing stations such as stackers 76 and 78, is a chain-indexed conveyer driven in the manner of the insert track 30. Examples of diversion stackers of the type shown in FIG. 1 are described in U.S. Pat. No. 3,652,828 to Sather et al. Segment 73A discharges

stuffed envelopes onto segment 73B. Segment 73B is a continuously running conveyor which extends along two postage meter processing stations 80 and 82.

An intrack detector processing station 84 is positioned along the insert track 30 to monitor for the presence of groups of documents on the insert track 30. The intrack detector 84 includes a conventional presence-sensing detector, such as photocell 86.

A data processing system 100 comprises a processor means which, according to differing embodiments, can be either (1) a multiprocessor comprising a plurality of microprocessors or (2) a microcomputer which includes a microprocessor capable of using a multitasking operating system. One example of a suitable microprocessor for such a microcomputer is the 9900 family of microprocessors marketed by Texas Instruments. The configuration of the DPS 100 and the connection of pins associated with the microcomputer is understood with reference to U.S. patent application Ser. No. 707,124 entitled "Insertion Machine with Global Data Bus" filed Feb. 28, 1985 by David Taylor (incorporated herein by reference). It is understood by those skilled in the art that an appropriate timer chip or clock is connected to the microprocessor, such as a conventional calendar clock which keeps track not only of the time of day, but also of the day of the week, month, and so forth.

The DPS 100 comprises memory means which includes memory portions in EPROM for storing operating system program instructions; portions in RAM for storing common (or global) identifier values; portions in RAM which serve as workspaces for the operating system; portions in EPROM into which is loaded the customized software system which comprises a plurality of concurrent programs; and, portions in RAM which serve as workspaces for the customized software system as such portions are allocated and supervised by the operating system.

The DPS 100 also includes I/O means comprising interrupt logic chips, input logic chips, and output logic chips. Interrupt and input signals are generated by various devices including photocells, detectors, switches, buttons, and the like, including such devices which are included in electronic circuits associated with various processing stations. Output signals from the DPS 100 are applied to various devices such as solenoids, lamps, and the like, including such devices which are included in electronic circuits associated with processing stations. Thus, various output signals are applied to electronic circuits associated with various processing stations so that the electronic circuits can, in turn, operate the particular device which actually performs the characteristic processing event for the respective processing station.

A printer 101 is connected to the DPS 100 through a conventional serial interface port such as a UART. In the illustrated embodiment printer 101 is of a type marketed by Texas Instruments as model 703.

Various processing stations are connected by electrical leads to the interrupt chips, input chips, and output chips comprising the DPS 100. For illustration convenience the electrical leads connecting the various processing stations to the DPS 100 are shown as a series of cables labeled "XC" wherein X corresponds to the reference numerals designating the particular processing station. The cables are shown as merging into a larger conduit cable 110 as they enter the DPS 100.

To obtain access to information relative to machine cycle execution events, a cable 112 is used to connect

the interrupt logic means of DPS 100 to a conventional machine cycle detection circuit 114 such as that shown in FIG. 3. The detection circuit 114 functions in combination with two rotational position sensors 116 and 116'. As shown in FIGS. 2A and 2B, rotational position sensor 116 includes a rotatable disc 118 which has one circumferential slit 120 thereon. As shown in FIGS. 2A and 2C, rotational position sensor 116' includes a rotatable disc 118' which has thirty six circumferential slits 120' thereon. The rotatable disc 118 is mounted on the main timing shaft 122 of the collating machine so that slit 120 permits the passage of light from a source 124 to a detector 126 once per machine cycle in a manner to create a train of timing pulses on line 132. The rotatable disc 118' is likewise mounted on the main timing shaft 122 of the collating machine so that slits 120' periodically permit the passage of light from a source 124' to a detector 126' to create a train of timing pulses on line 132'. Two inverting drivers 128, 130 are connected in series to the output terminal of detector 126, with the output of driver 128 being connected to a line 132 included in cable 112. Likewise, two inverting drivers 128' and 130' are connected in series to the output terminal of detector 126', with the output of driver 128' being connected to a line 132' included in cable 112. In the embodiment discussed herein, the machine cycle detector circuit 114 causes the application of an interrupt signal on line 132 once every machine cycle and an interrupt signal on line 132' every 10 degrees of machine cycle rotation. The output terminal of driver 128' is also connected to an input terminal of a one-shot 134. An output terminal of one-shot 134 is connected to a line 136 included in cable 112. The timing parameters of one-shot 134 are set so that output pulses on line 136 have a pulse width sufficiently large that a TRUE signal is continuously applied on line 136 as long as disc 118' is rotating (i.e. as long as the machine is running). The DPS periodically checks the status of the signal on line 136 to ensure that the insertion machine is running. Such checks are made as safety checks, for example, by various concurrent programs before processing is effected by the associated processing stations.

As described in U.S. patent application Ser. No. 707,124 entitled "Insertion Machine with Global Data Bus", filed on Feb. 28, 1985 by David Taylor, the DPS 100 has loaded therein a customized software system comprising a plurality of concurrent programs. Various ones of the concurrent programs are associated with a particular type of processing station and include one or more concurrent tasks. The tasks comprising such programs are executable sets of instructions configured for performing various processing event-related functions. In one embodiment the data processor 100 includes a multitasking operating system which facilitates independent execution of the plurality of concurrent programs.

A system global data bus SBUS is accessible by a plurality of concurrent programs. SBUS comprises a plurality of data records, each data record corresponding to one of a plurality of groups of documents being indexed along insert track 30 and having informational data elements relative to processing events performable with respect to that group of documents by various ones of the processing stations. By interfacing with SBUS the concurrent program associated with a particular processing station can, depending upon the nature of the characteristic processing event, perform logic required for the characteristic processing event either as

early or as late as practical prior to the actual occurrence of the characteristic processing event.

SBUS is a system global (i.e. common) variable of the type TRACKREC. In fact, SBUS is defined as follows:

SBUS: ARRAY[0..BBUSLMI] OF TRACKREC
TRACKRFC is defined in the Pascal language as follows:

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TRACKREC = RECORD
    BITS:BITSTYPE;
    NUMBERS:ARRAY[1 .. BNUMMAX]
    OF INTEGER
END;

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wherein BITSTYPE is itself declared a type as follows:

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BITSTYPE=PACKED ARRAY [0..BBITMAX]
OF BOOLEAN;

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BBITMAX is an integer constant; and
BNUMMAX is an integer constant.

The global variable SBUS is conceptualized as an array of records, each record being of the type TRACKREC. As illustrated in FIG. 4, SBUS is a given a two-dimensional representation wherein each record of the array SBUS is described as a column. The column associated with each record of the array includes a number of rows equal to the sum of the value of the identifiers BBITMAX (representing BBITMAX number of packed Boolean elements) and BNUMMAX (representing BNUMMAX number of integer elements). In the example discussed herein the integer values of the identifiers BBITMAX and BNUMMAX are preset by the machine builder in a concurrent program GENESIS to the constant values 53 and 4, respectively. In accordance with this example, each record of the array SBUS includes 53 packed Boolean elements (representing Boolean information relative to the processing of the insertion machine system of a particular customer's documents) and 4 integer elements (representing integer information relative to the processing by the insertion machine of the same particular customer's documents).

Further in accordance with the example, the FIG. 4 illustration of SBUS shows BBUSLEN=20 number of records, the value of BBUSLEN being determined on the basis of a preset constant and equal to BBUSLMI+1. BPUSLEN represents the number of customers whose documents which can simultaneously undergo active processing (i.e. the number of customers whose documents are simultaneously being indexed in accordance with a machine cycle). It should be well understood by the man skilled in the art that the format of SBUS can be reconfigured as required to take into consideration inter alia a lengthening or contracting of the overall collating machine system (thus affecting the value BBUSLEN).

Bits 1 through 3 of the packed Boolean array portion of each record of SBUS are set to either a "True" or "False" value depending upon whether the control indicia requires the feeding of documents from a possible plurality of downstream (i.e. non-control station) reading-type insert stations corresponding to bits 1 through 3. For example, bit 1 set "True" indicates that a first downstream reading-type insert station is to feed; bit 2 set "True" indicates that a second downstream reading-type insert station is to feed; and so forth. In differing embodiments a greater or smaller number of

bits corresponding to bits 1 through 3 are included in SBUS in accordance with the number of reading-type insert stations required by the user. In the example of FIG. 1 there are no downstream reading stations so that bits 1, 2, and 3 are all set "False".

Bits 4 through 19 of the packed Boolean array portion of each record of SBUS are each set to either a "True" or "False" value depending upon whether the control indicia requires that the respective standard gripper-type insert station feed a document. Bits 4 through 19 are associated on a one-to-one basis with as many as 16 corresponding standard gripper insert stations. The machine builder specifies which of the bits 4 through 19 correspond to each standard gripper insert station. For the example of FIG. 1 the builder has specified that bits 4 through 9 correspond with insert stations 52 through 57, respectively. After the indicia on the control document is read at the control station, and in accordance with the builder's specification, bits 4 through 19 are appropriately set in the record for the customer then at the control station.

Bits 28, 29, and 30 of the packed Boolean array portion of each record of SBUS are standard diversion status bits which are used in the control of as many as three respective diversion mechanisms (such as lifter fingers or diversion gates). Bits 28, 29, and 30 are generally set in accordance with the read indicia after reading occurs at the control station. Diversion based on a "True" setting of the standard diversion bits 28, 29, or 30 may be desired in situations, for example, where the corresponding customer's envelope has an overseas address or is internal corporate mail.

Bits 51, 52, and 53 of the packed Boolean array portion of each record of SBUS are postage meter status bits which are used for the control of as many as three respective postage meters. The postage meters are set whereby each meter applies a different postage amount. When the weight of a stuffed envelope is determined, either the concurrent program CW or the concurrent program corresponding to the particular control station being utilized, sets an appropriate one of the postage meter status bits 51, 52, or 53.

The four integer values included in each record of SBUS have the variable identifiers BMAT1, BMAT2, BPCNT, and BWGHT. BMAT1 expresses the read control indicia value in binary format. BMAT2 expresses the read control indicia value in binary coded decimal format. BPCNT is an integer count of the number of documents associated with a particular customer. BWGHT is the computed weight of the documents associated with a particular customer. The values of BMAT1 and BMAT2 are determined after the reading of the control indicia and are placed into SBUS under the control of the concurrent program associated with the control station. In general, the values of BPCNT and BWGHT are updated at each reading-type insert station concurrent program associated with the appropriate insert station and are ultimately calculated by the concurrent program CW when the computer weighing feature is utilized.

With further reference to FIG. 4, a pointer BINDEX points to the record in SBUS corresponding to the customer whose document(s) are at the upstream-most processing station of the insertion machine. The conceptualized position of pointer BINDEX corresponds to the current integer value of a system global variable BINDEX in the customized software system. The

global variable BINDEX represents the record number of the upstream-most processing station. The contents of records are thus not shifted from record-to-record through SBUS; rather, BINDEX is decremented (by a function BUS & ROTBUS) with each machine cycle to specify which record currently corresponds to the upstream-most processing station. Upon decrementation of BINDEX the value of BINDEX is checked to determine whether it equals zero, in which case the value of BINDEX is set at the value of BBUSLEN-1.

FIG. 6 shows a system panel 140 also known as an input and display console. Panel 140 includes thereon a mode display 142; a mode select pushbutton 144; an output display 146; a feeder/station select pushbutton 148; a data input keyboard 150; a station select mode keyboard 152; a read status display 154; a delivery status display 156; and, an audit trail keyboard 157.

Mode select pushbutton 144 is used in conjunction with a hereinafter-described concurrent program CW to switch program CW into one of four potential I/O modes. Three of the I/O modes—the TOTAL, STATION, and QUANTITY I/O modes—are enterable only when concurrent program CW is in an overall CALCULATION mode. The PROGRAM I/O mode is not enterable when concurrent program CW is in its

CALCULATION mode. Each I/O mode, described in more detail hereinafter, is associated with an illuminatable display element in display 142. In this respect, the TOTAL mode is associated with display element 142A; the STATION mode is associated with display element 142B; the QUANTITY mode is associated with display element 142C; and, the PROGRAM mode is associated with display element 142D. Assuming that the insertion machine is mechanically running, upon depressing the mode select button 144 a first time, concurrent program CW enters its TOTAL display mode and element 142A is lit. Upon depressing the mode select button 144 a second time, concurrent program CW enters its STATION display mode and element 142B is lit. Upon depressing the mode select button 144 a third time, concurrent program CW enters its QUANTITY display mode and element 142C is lit. If the insertion machine is not mechanically running, a fourth depression of mode select button 144 enables concurrent program CW to enter its PROGRAM mode and accordingly element 142D is lit. If the insertion machine insert track is being advanced upon the fourth depression of the mode select button 144, the concurrent program CW again enters its TOTAL mode and element 142A is again lit. Thus, repeated depressing of mode select button 144 causes the concurrent program CW to cycle through its modes. When the insertion machine is not physically running, depressing mode select button 144 allows concurrent program CW to cycle through all of its I/O modes including the PROGRAM mode. Otherwise the mode select button enables the operator to cycle through the TOTAL, STATION, and QUANTITY modes.

The output display 146 has two sets of LED—type display elements provided thereon—a first set comprising elements 146A and 146B and a second set comprising elements 146C through 146G. Display elements 146A and 146B are coordinated with the feeder/station select pushbutton 148. In certain I/O modes of the concurrent program CW the feeder/station select pushbutton 148 is employed to specify for which of the feeder or gripper stations (e.g., stations 42, 52, 53, 54, 55, 56 or

57) the numerical display depicted in elements 146C-146G pertains. For example, when in PROGRAM mode the specification is indicated by display elements 146A and 146B which together display a "F1" for feeder station 42, a "1" for first gripper station 52, a "2" for second gripper station 53 (and so forth up to "6" for the sixth gripper station 57), and an "E" for the envelope station 50.

Display elements 146C-146G are used for the display of a five digit number. In this connection, as the concurrent program CW is in a CALCULATION mode, the five digit number displayed by elements 146C-146G can be (1) the calculated projected total weight of a customer's stuffed envelope (during the TOTAL I/O mode); (2) the per-document weight at the station currently displayed by elements 146A and 146B (during the STATION I/O mode); or (3) the cumulative number of inserts fed during the lowest order time frame from the station currently displayed by elements 146A and 146B (during the QUANTITY I/O mode).

During the PROGRAM mode, the five digit number displayed by elements 146C-146G is the per-document weight of the station currently displayed by elements 146A and 146B. The data input keyboard 150 can be used to change the value displayed by elements 146C-146G, and hence the per-document weight of the station currently displayed by elements 146A and 146B, when the concurrent program is in the PROGRAM mode. In this regard, pushbutton 150A is used to cycle a pointer through the digits corresponding to display elements 146C-146G; pushbutton 150B is used to decrement the digit corresponding to the display element indicated by the pointer; and, pushbutton 150C is used to increment the digit corresponding to the display element indicated by the pointer.

With respect to the display elements 146C-146G, in the TOTAL, PROGRAM, and STATION modes a decimal point is provided so that the values displayed in display elements 146E-146G are right of the decimal point. In the QUANTITY mode no decimal is provided inasmuch as a positive integer is displayed.

The station select mode keyboard 152 is used to confirm that an insert station is operating in a SELECT mode (as opposed to an ON or OFF mode). It will be recalled that in the SELECT mode that the determination whether the insert station will feed a document for a customer is based on the indicia on the customer's control document. Buttons 152A-152F are provided for insert stations 52-57, respectively. When a button 152 is pressed for an insert station on panel 140, and when a similar button is pressed for that station on the unillustrated machine control panel, the station is placed in the SELECT mode. Display LEDs 158A-158F, associated with respective buttons 152A-152F, are illuminated when the corresponding button 152 has been depressed to place the station indicated thereby in the SELECT mode.

The read status display 154 includes LEDs 154A-154E. Appropriate ones of the LEDs 154A-154E are illuminated with respect to each customer at approximately the point in time at which indicia-read and calculated data for the customer is loaded into SBUS. For example, if it is determined that the customer whose data is being loaded into SBUS will eventually have his envelope diverted, LED 154B is illuminated. On the other hand, if it is determined that postage meter 80 will eventually be activated to apply postage to the envelope

for the customer whose data is being loaded into SBUS, LED 154D will be illuminated.

The delivery status display 156 includes LEDs 156A-156D. The LEDs 156A-156D are illuminated when the processing stations associated therewith are actually activated. For example, when the divert stacker 76 is actually activated the LED 156A is illuminated. When the postage meter 80 is actually activated the LED 156C is illuminated.

The audit trail keyboard 157 has an audit trail start pushbutton 160 and a series of audit trail accumulate pushbuttons 162A-162E. As seen hereinafter, each accumulate pushbutton 162 is associated with a particular time base or time frame and serves to initiate the addition of contents of audit counter memory location of that particular time frame to the contents of corresponding audit counter memory locations for a higher order time frame.

FIG. 5 is a table depicting various memory locations in a non-volatile portion (i.e. battery backed-up RAM) of the memory means of the DPS 100, including memory locations associated with a plurality of audit counters having addresses represented by reference numerals 200-299 and memory locations associated with a plurality of audit timers having beginning addresses represented by reference numerals 360, 365, 370, 375, and 380. Each of the audit counters have five memory locations associated therewith, each of the five memory locations for an audit counter being associated with a particular time frame or time base. For example, the audit counter which pertains to the number of documents fed from the control station has memory locations represented by reference numerals 200-204 associated therewith. For this particular audit counter, the memory location 200 is used to store a count kept for a time base labeled FRAME1; the memory location 201 is used to store a count kept for a time base labeled FRAME2; and so on up to memory location 204 used to store a count kept for a time base labeled FRAME5. Thus, it is seen that each of the audit counters shown in FIG. 5 has five non-volatile memory locations associated therewith, the five memory locations being employed to store counts kept over five corresponding time bases.

The five time frames or time bases for which audit counts are user determined but have a hierarchical arrangement. In this respect, whenever audit counters associated with FRAME1 are accumulated such as by the pressing of button 162A) the contents of those counters are automatically added to the contents of the respective audit counters maintained for FRAME2 (after which the audit counters associated with FRAME1 are cleared). Whenever the audit counters associated with FRAME2 are accumulated (such as by the pressing of button 162B) the contents of those counters are automatically added to the contents of the respective audit counters maintained for FRAME3, and so forth.

In the embodiment described herein, FRAME1 corresponds to a current shift or batch; FRAME2 corresponds to the current week; FRAME3 corresponds to the current month; FRAME4 corresponds to the current calendar quarter; and, FRAME5 corresponds to the current year. Thus, at the end of a shift or run an operator hits the pushbutton 162A, at which time the contents of the memory locations 200, 205, 210, 215 . . . 295 are added to the contents of respective memory locations 201, 206, 211, 216, . . . 296. Likewise, at the

end of a week the operator hits the pushbutton 162B, at which time the contents of the memory locations 201, 206, 211, 216, . . . 296 are added to the contents of the memory locations 202, 207, 212, 217, . . . 297. It is understood that other user-determined conventions for the five frames can be employed.

The audit counters shown in FIG. 5 include counters 200-204 which count for respective time bases the number of documents fed from the control station (such as station 42); counters 205-209 which count for respective time bases the number of customers processed by the control station; counters 210 through 249 which count for respective time bases and respective insert stations the number of documents fed from the standard insert stations (such as stations 52 through 57); counters 245-249 which count for respective time bases the number of envelopes diverted by the first stacker (stacker 76); counters 250-254 which count for respective time bases the number of envelopes diverted by the second stacker (stacker 78); counters 255-259 which count for respective time bases the number of envelopes metered by the first postage meter (meter 80); counters 260-264 which count for respective time bases the number of envelopes metered by the second postage meter (meter 82); counters 265-269 which count for respective time bases the number of envelopes fed; counters 270-274 which count for respective time bases the total number of machine stops; and, counters 275 through 299 which count for respective time bases and by type the number of machine stops (e.g., the number of system stops, the number of stop bar stops, the number of jam stops, and the number of double feed stops; and the number of miss stops). In addition, charge-back counters 240-244 count for respective time bases the number of documents fed from the charge back third party advertising station which cause the groups with which the documents become associated to increase in weight sufficiently to jump into a greater postage amount category.

Elaborating on the types of machine stops mentioned above, a system stop occurs as a result of a real time operating command of DPS 100. In this respect, a system stop can occur for example when the DPS 100 detects a misread, when a read indicia indicates that the system is to be stopped in connection with an alert and clear, or when it is determined that an unusually large number of documents are being fed from a station for a customer.

A "stop bar" stop occurs when an operator pushes one of the "stop" bars conveniently located for operator intervention of the machine operation. Such operator intervention can occur, for example, when the operator visually detects an irregularity or between operator shift changes or operator breaks.

An insertion machine such as that depicted in FIG. 1 has a jam detection device at each insert station for detecting document jams. The jam detection devices are connected to DPS 100 but are also interconnected in a manner whereby the detection of a jam at one of the insert stations can stop the insertion machine, resulting in a jam stop.

An insertion machine such as that depicted in FIG. 1 also has a mistake detector device at each gripper-type insert station to detect whether a proper number of documents have been vacuum-deflected and engaged between jaws of the gripper arm. One embodiment of such a mistake detector used for detecting the occurrence of "misses" or "doubles" is disclosed in U.S. patent application Ser. No. 06/648,399 filed on Sept. 7,

1984 by Zemke et. Signals indicative of mistakes resulting from a miss or double are noted by the DPS 100 and cause the DPS 100 to stop the insertion machine.

The audit timers commencing at locations 360, 365, 370, 375, and 380 are used to keep track of various time-related values. Audit timer 360 is used to store therein the last referenced calendar time (i.e., the time indicated by the calendar chip when the chip was last consulted in connection with either a machine start or machine stop). Audit timer 365 has stored therein the total machine fault or idle time for time base FRAME1. Audit timer 370 has stored therein the total actual machine run time for time base FRAME1. Audit timer 375 has stored therein the calendar time elapsed since the beginning of the time base FRAME1 (i.e. the sum of machine run time and machine fault time since the commencement of FRAME1). Upon starting and stopping of the insertion machine the calendar chip included in the DPS 100 is consulted; arithmetic operations are performed on the obtained time readings to derive a value representative of a time interval during which the machine has been either running or idle; and, the representative time interval value is added to the audit timer 375 and to the appropriate one of the audit timers 365 or 370.

FIG. 5A illustrates various locations included in the RAM memory of the DPS 100 which are used as temporary storage locations for statistics indicative of machine performance averages. In particular, a memory location having an address represented by reference numeral 385 is used to store a calculation of the average machine cycle speed for time FRAME1; a memory location having an address represented by reference numeral 386 is used to store a calculation of the average number of envelopes completed per hour for FRAME1 (based on the calendar time elapsed since the beginning of FRAME1); and, a memory location having an address represented by reference numeral 387 is used to store a calculation of the average number of envelopes completed per actual run hour for FRAME1 (based on the amount of time the machine has actually run since the commencement of FRAME1). As seen hereinafter the calculation for the values stored in locations 385, 386, and 387 are made when an audit report is requested by the pressing of pushbutton 160. Upon such request, the values stored in locations 385, 386, and 387, being indicative of machine performance averages, are transmitted to the printer 101 for preparation of the audit report.

First Embodiment Operation

In operation an operator turns on the DPS 100 which initially executes a GENESIS program included in the custoxized software system stored in EPROM. The GENESIS program is configured to (1) define system "constants" for the customized software system; (2) define various Microprocessor Pascal TM language "types"; (3) define a set of system "common" (also known as system "global") parameters which are universally accessible; (4) list a series of external standard operating system procedures and functions which the custoxized software system will require during its execution; (5) list external procedures and functions which the custoxized software system will require during its execution; (6) define various bus-interfacing procedures and functions which facilitate the accessing and operation upon a system global variable herein referred to as SBUS; and, (7) define an initial execution sequence of

procedure calls and start commands to initiate independent execution of a plurality of concurrent programs.

In the embodiment described herein each concurrent program can comprise one or more concurrent tasks, with each concurrent task comprising instructions coded in the Microprocessor Pascal TM language. Various ones of the concurrent tasks may suspend their own execution and be posted on an appropriate one of a plurality of semaphores. For example, if a concurrent task desires to suspend its execution until the machine cycle reaches a particular point, that concurrent task is placed on a semaphore which will be signaled in accordance with the machine cycle detection. Signaling of such a semaphore is facilitated by a concurrent program MMONITOR which updates appropriate ones of the semaphores with indications of the machine cycle position status. When indications of the machine cycle position status. When the semaphore on which the suspended concurrent task is notified by the program MMONITOR that the particular point in the machine cycle has been reached, the selfsuspended task resumes its execution.

One of the concurrent programs which is independently executable by the DPS 100 is the concurrent program CW. Current program CW includes four I/O modes: (1) a PROGRAM mode wherein input information is associated with the processing stations; (2) a QUANTITY mode wherein the number of documents feed from a particular selected insert station is displayable; (3) a STATION mode wherein the per document weight at an input-requested insert station is displayable; and, (4) a TOTAL mode wherein the projected weight for a customer's stuffed envelope is calculated.

The concurrent program CW can enter its PROGRAM mode after the DPS has been turned (but prior to the start of the physical running of the insertion machine) by hitting the mode select key 144 on panel 140 a sufficient number of times to light up the "PROGRAM" LED mode display light 142D. Execution of the PROGRAM mode enables the operator to store in RAM memory in the data processing means 100 data pertinent to the per document weight at selected insert and envelope stations and to display indications of the same on the panel 140. The operator uses the feeder/station select pushbutton 148 to specify for which of the processing stations data is to be entered. Upon each depression of the pushbutton 148 a different station code is displayed on elements 146A and 146B. For example, upon hitting button 148 a first time the code "F1" is displayed in elements 146A and 146B. Code "F1" corresponds to the first feeder station (i.e. control station 42). Upon hitting button 148 a second time the code "1" is displayed in elements 146A and 146B. Code "1" corresponds to the first standard gripper station (i.e. insert station 52). Upon repeated hitting of button 148, the codes "2" (for station 53), "3" (for station 54), "4" (for station 55), "5" (for station 56), "6" (for station 57), "E" (for envelope station 50), "F1" (for station 42), "1" (for station 52), etc., are sequentially displayed.

While a station has its station code displayed on display elements 146A, 146B during the PROGRAM mode of concurrent program CW, the per document weights for that station can be entered into RAM memory (and displayed on display elements 146C-146G) using the data entry keyboard 150. The key 150A is used to specify for which of the display digits 146C-146G data is being entered, e.g. the tenths ounce digit (corresponding to display element 146E), the hundredths ounce

digits (corresponding to display element 146F), or the thousandths ounce digit (corresponding to display element 146G). Each display element 146 has included therein a special digit select indicator which is illuminated to indicate that the particular element has been selected by pushbutton 150. For example, upon the first depression of button 150 the digit select indicator associated with display element 146E indicates that element 146E is specified, upon the second depression of button 150 the digit select indicator associated with display element 146F indicates that element 146F is specified, and so on. Once one of the display digits 146E-146G is specified for a station, the contents of that digit can be decremented (using pushbutton 150B) or incremented (using pushbutton 150C) until the desired data value 0-9 is displayed for that station.

It is understood that inputting of data through keyboard 150 in this manner affects not only the values displayed on the elements 146C-146G but also determines the per document weight values stored in appropriate storage locations in RAM for the selected station. For example, with reference to FIG. 5A, the memory location at which the per document weight value for the control station 42 is stored is an address represented by reference numeral 389; the memory location at which the per document weight value for the insert station 52 is stored is an address represented by reference numeral 390; the memory location at which the per document weight value for the insert station 53 is stored is an address represented by reference numeral 391; the memory location at which the per document weight value for the insert station 54 is stored is an address represented by reference numeral 392; the memory location at which the per document weight value for the insert station 55 is stored is an address represented by reference numeral 393; the memory location at which the per document weight value for the insert station 56 is stored is an address represented by reference numeral 394; the memory location at which the per document weight value for the insert station 57 is stored is an address represented by reference numeral 395.

Thus, from the foregoing it is seen that during the PROGRAM mode of the concurrent program CW the operator can input or change the per document weight values for any or all of the stations 42, 52-57 and 50.

When the concurrent program CW is taken out of the PROGRAM mode by a further depression of the mode key 144, and before the operator is ready to begin the insert feeding, inserting (i.e. envelope stuffing), and exit stage processing operations, the operator has an opportunity if desired to accumulate the audit counters and timers for FRAME1. Accumulation of the audit counters for FRAME1 is generally desired upon the commencement of a new job or new batch of documents for which the operator desires to have a statistical report. Upon the pressing of the pushbutton 162A the audit counters and audit counters 365, 370, 375 and 380 for FRAME1 are added to corresponding audit counters and audit timers for FRAME2. After the accumulation the FRAME1 audit counters and audit timers for addresses 360, 365, 370, 375, and 380 are set to zero. If button 162A is not pressed upon machine start up, the audit counters will continue to have stored therein the values that were current at the point in time at which the last machine stop occurred.

When the operator is ready to commence the feeding of inserts, envelope stuffing, and envelope exit stage

processing, the operator commences start up by pressing an unillustrated START button on the machine control panel. Upon pressing of the START button the drive motor of the insertion machine is actively coupled to the rotating shafts discussed above, including the incrementing rotating shafts which serve to advance the insert track indexing chain 30 and the envelope track indexing chain 48. Moreover, upon the pressing of the START button a determination is made whether FRAME1 accumulate pushbutton 162A has just been pressed. If accumulate pushbutton 162A has been pressed in connection with this machine start, the current calendar time expressed by the calendar timer chip is loaded into the address 360 and becomes the last referenced calendar time (the audit timers for addresses 365, 370, 375, and 380 having already been zeroed). If the accumulate pushbutton 162A has not been pressed in connection with this machine start, the last referenced calendar time stored at address 360 is subtracted from the current calendar time expressed by the calendar timer chip. The subtraction results are added to the contents of address 365 (the fault or idle time for FRAME1). After the subtraction the current calendar time is loaded into the address 360 and becomes the last referenced calendar time.

Upon physical start up of the insertion machine the control station 42 advances a web of documents; reads indicia on documents; cuts documents from the web; collects a related group of documents belonging to a customer; and, discharges the customer's related group onto the insert track 30. In this regard, the operation of control station 42 is understood from the already-incorporated U.S. patent application Ser. No. 707,124 filed Feb. 28, 1985 by David Taylor. Program instructions included in the concurrent tasks associated with the control station 42 supervise the counting of the number of customers processed by the control station 42 and of the number of documents cut from the web for each customer (i.e. the number of documents that will be fed from the control station for each customer) and, upon feeding of a customer's documents, stores the counts in respective global memory locations.

As a customer's documents are discharged onto insert track 30 by the control station 42, a record of information is loaded into SBUS for that customer. The loaded information for the customer is conceptualized as corresponding to a column in the FIG. 4 representation of SBUS. The loaded information is based at least partially upon indicia read with respect to that customer's documents, including read indicia indicative of which downstream insert stations are to feed if the respective stations are in a SELECT mode. In this regard, record elements (i.e. bit positions) 5 through 10 correspond to information indicative of whether the first through sixth standard insert stations (i.e. stations 52 through 57) are to feed inserts for the customer.

After a customer's documents are discharged onto insert track 30 and after a record corresponding to the customer has been loaded into an appropriate record position in SBUS, the concurrent program CW is signalled to begin execution of its CALCULATION mode for that customer. In particular, for the embodiment of FIG. 1, the CALCULATION mode portion of concurrent program is signalled for a customer at a relatively late point in the same machine cycle in which the customer's documents are discharged from control station 42 onto insert track 30. As a general rule the CALCULATION mode portion of the concurrent program CW

is signalled for a customer at a late stage of the same machine cycle in which documents for that customer are fed onto the insert track 30 from the downstream-most reading insert station.

A portion of the processing conducted by the CALCULATION mode of concurrent program CW is shown in FIG. 7. In particular, the processing steps shown in FIG. 7 are executed for each customer at the appropriate time as described above. Processing begins for each customer by clearing a weight calculation register (step 400) which will be used to calculate a projected weight for the customer's stuffed envelope.

After the weight calculation register is clear, steps 401-406 are executed for a customer in connection with the control station 42. At step 401 the concurrent program CW fetches the per document weight for the control station 42 from location 389 in volatile RAM memory (see FIG. 5A). At step 402 concurrent program CW determines the number of documents fed for the customer from control station 42. In this respect, the number of documents fed for the customer is obtained from a global counter which is maintained by a concurrent task associated with the control station 42 (as, for example, concurrent task COUNT described in U.S. patent application Ser. No. 06/707,124 to Dave Taylor already incorporated herein). The number of documents fed for the customer from the control station 42 is added at step 403 to the audit counter which has address location 200 in the non-volatile memory (see FIG. 5) and at step 404 to a global piece counter BPCNT. Upon completion of concurrent program CW's CALCULATION mode for this customer the counter BPCNT will be used as a tally for the number of inserts which will ultimately be included in the customer's stuffed envelop.

Knowing the number of documents fed for this customer from the control station 42 and the per document weight, at step 405 the concurrent program CW multiplies these two factors to obtain the total weight of the sub-group of documents fed from the control station 42. At step 406 the multiplication product is added to the weight calculation register.

A loop commencing at symbol 407 of FIG. 7 is executed a number of times corresponding to the number of non-third party advertising stations included in the insertion machine. In this regard, for the embodiment of FIG. 1 the loop commencing at symbol 407 is executed four times, each execution corresponding to one of the four insert stations 52 through 55.

During the loop which commences at symbol 407 a determination is first made (step 408) whether the station of interest for this execution of the loop (represented by the identifier STATION(1) in FIG. 7) was designated to be in a "OFF" mode during the program mode of the current program CW. If the station is "OFF", the station cannot feed under any circumstance and thus the processing jumps to the end of the loop (represented by symbol 411). If the station is not in the "OFF" mode, a determination is then made (step 409) whether the station is in the "ON" mode and thus required to feed regardless of indicia. If a station is not determined to be in the "ON" mode at step 409, the station is in the "SFLECT" mode and the particular indicia read for this customer at the control station 42 becomes important. When a station is in the "SELECT" mode the concurrent program CW at step 410 accesses SBUS to determine whether or not the "select" bit corresponding to the station of interest for this execution

of the loop has been set (indicating that this station is selected to feed). For example, with reference to the execution of the loop for insert station 52 the fifth bit of the customer's record in SBUS is consulted as an indication of indicia select determination; with reference to the execution of the loop for insert station 53 the sixth bit of the customer's record in SBUS is consulted as an indication of indicia select determination; and so forth. If the indicia indicates that the station has not been selected to feed, processing jumps to the end of the loop (represented by symbol 411).

Steps 412 through 416 are executed when the station of interest for this particular execution of loop 402 is either (1) in the "ON" mode, or (2) if the station is in the "SELECT" mode and the read indicia indicates that the station is to feed. In this regard, at step 412 the per document weight for the station is fetched from the appropriate memory location in which it was stored during the program mode of concurrent program CW. For example, in the execution of the loop for insert station 52 the contents of memory location 390 is fetched as the per document weight for station 52; in the execution of the loop for insert station 53 the contents of memory location 391 is fetched as the per document weight for station 53; and so on. After the per document weight for inserts at this station is so obtained, it is multiplied by the number of documents fed from the station (which in most cases will simply be one) (step 414). At step 416 the multiplication product is added to the weight calculation register to reflect the increase in the projected weight of the customer's stuffed envelope in anticipation of the station of interest for this execution of the loop feeding an insert document.

At step 417 a counter which counts the number of documents fed for the station of interest for this execution of the loop is incremented in accordance with the number of documents so fed. For the embodiment of FIG. 1, this particular counter corresponds to the appropriate one of the audit counters represented by addresses 210, 215, 220, or 225, depending upon which respective insert station 52, 53, 54, 55 is associated with this execution of the loop. At step 418 a global piece counter BPCNT is incremented for this customer in accordance with the number of feeds from the station of interest is used as a tally for the number of inserts which ultimately will be included in each customer's stuffed envelope.

Thus the loop bearing symbols 407 through 411 as shown in FIG. 7 is executed for each of the non-third party advertising stations (in the embodiment shown for stations 52, 53, 54, and 55). At the end of the last execution of this loop the weight calculation register will contain a value indicative of the sum of the weights of the documents expected to be fed from the control station 42 and from the non-third party advertising stations for this customer.

Steps 420, 422, and 424 as depicted in FIG. 7 involve the addition to the weight calculation register of a value representative of the weight of the envelope. In particular, at step 420 it is determined whether or not an envelope is to be fed for the customer. In this regard, if an envelope is to be fed, at step 422 the concurrent program CW fetches the envelope weight from the memory address 396 whereat a value indicative thereof was stored during the PROGRAM mode. The fetched envelope weight is (at step 424) added to the weight calculation register. In addition, at step 425 the contents of

memory address 265 is incremented to update the counting of the number of envelopes fed.

Thus far the weight calculation register includes a sum representing the weight of the envelope and the weight of inserts fed from the control station 42 and from the non-third party advertising insert stations. In a loop commencing at symbol 428 the concurrent program CW determines which of the third party advertising stations are permitted to feed an insert and adds to the weight calculation register the weight of those inserts. The loop commencing at symbol 428 is executed for each of the third party advertising stations included in the overall insertion machine configuration. For the particular embodiment shown in FIG. 1, the loop commencing at symbol 428 is executed twice—once for third party advertising station 56 and once for third party advertising station 57.

Processing for the loop commencing at symbol 428 begins by determining whether the indicia for the customer indicates that the third party advertising station of interest for this execution of the loop has been selected (step 430). Whether the customer's indicia indicates that the station was selected is determined by accessing the appropriate bit in SBUS which corresponds to the station of interest for this execution of the loop. In this respect, for the execution of the loop for station 56 the ninth bit of the customer's record in SBUS is examined. For the execution of the loop for station 57 the tenth bit of the customer's record in SBUS is examined. If SBUS indicates that the station has been selected, or if it is determined (at step 432) that the station is in the "ON" mode, a determination is made (at step 434) whether the feeding of a third party advertising document from the station would increase the weight of the customer's stuffed envelope sufficiently to require additional postage.

If it is determined that a document can be fed from the third party station of interest for this execution of the loop without increasing the weight of the customer's stuffed envelope sufficiently to require greater postage, an inclusion fee counter for the station is incremented at step 436 to anticipate the permitted feed of the station and to provide a bookkeeping indication of the permitted feed so that the third party advertiser can appropriately be billed. If the feed from the station is permitted, the per document for documents fed from the station is fetched from the appropriate memory location such as address 394 or 395 (step 438) and the fetched weight for a document fed from this station is added to the weight calculation register (at step 440). Moreover, at step 441 the piece counter BPCNT for this customer is incremented to reflect the inclusion of the document fed from this station of interest.

If it is determined at step 434 that the feed of a third party advertising document from the station of interest for this execution of the loop would result in additional postage for the customer, a determination is made at step 442 whether the station of interest is a "charge back" station. In the situation where the "charge back" determination is affirmative, the third party advertiser has instructed that his insert be included despite the additional postage cost and has agreed to assume the additional postage cost occasioned by the inclusion of his insert. In the illustrated embodiment, only station 57 is designated a charge-back station. Accordingly, when the feeding of an insert from station 57 causes a customer's stuffed envelope to jump into a higher postage category, at step 444 an extra postage counter (the audit

counter having address 240) is incremented for the charge back station. Thereafter steps 436, 438, 440, and 441 are executed for the charge back station.

If during the execution of the loop commencing at symbol 428 the determinations of steps 430 and 432 are both negative, the loop is concluded for that station. If the determination at step 442 is negative (i.e. the station is not a charge-back station), the bit in SBUS corresponding to the station of interest for that execution of the loop, having previously been set, is unset (step 445) inasmuch as it has been determined that the station cannot be permitted to feed.

Thus, at the end of the last execution of the loop commencing at symbol 428 the weight calculation register for the customer contains the projected calculated weight of the customer's stuffed envelope, including the weight of the envelope, the weight of the inserts added at the control station and the non-third party advertising stations, and the weight of the inserts added at the third-party advertising stations.

After execution of the loop commencing at symbol 428, steps 448 and 449 are performed in order to load appropriate information into SBUS. In particular, at step 448 the value in location BPCNT reflecting the total number of inserts fed with respect to this customer is loaded into the third integer element of the integer portion of the customer's record in SBUS. An integer value related to the value contained in the weight calculation register for this customer is loaded into the fourth integer element (element BWGHT) in the integer portion of this customer's record in SBUS (step 449).

Various other steps shown in the portion of the CALCULATION mode of concurrent program CW illustrated in FIG. 7 concern the setting of postage meter bits in SBUS and the incrementation of counters associated with the postage meters (such as postage meters 80 and 82 of FIG. 1). In this regard, at step 450 it is determined whether the value in the weight calculation register for this customer qualifies for the 0 to 1.00 ounce postage weight classification. If the value in the weight calculation register so qualifies, the appropriate bit in SBUS (i.e. bit 51) corresponding to the postage meter 80 is set (step 452), assuming postage meter 80 to be preset to apply the correct amount of postage for this weight classification. Further, the audit counter (at address 255) indicative of the number of envelopes metered by the first postage meter 80 is incremented (step 454). If the value in the weight calculation does not qualify the envelope for the 0 to 1.00 ounce postage weight classification, a check is made to determine (at step 456) whether the value in the weight calculation register corresponds to the 1.00+ to 2.00 ounce postage weight classification. If the determination is affirmative, the bit in SBUS corresponding to the second postage meter 78 (i.e., bit 52 of SBUS) is set (step 458). Also, the audit counter (at address 260) for the number of envelopes and metered by the second postage meter 82 is incremented (step 460), assuming the second postage meter 82 to be preset to apply the correct postage for this classification range. If the determination at step 456 is negative, depending upon the embodiment utilized the operator is either apprised of an error or the stuffed envelope will eventually be diverted.

With each revolution of disc 118 a pulse is created by virtue of the transmission of light through the slit 120 in disc 118. For each pulse an interrupt is applied to DPS 100 on line 132. Upon receipt of the machine cycle interrupt the concurrent program MMONITOR incre-

ments the memory location 380 whereat the machine cycle count for FRAME1 is maintained.

At various points in the processing it may be determined that a customer's envelope should be diverted (for any one of a plurality of operator predetermined reasons) rather than be metered. A determination to divert a customer's envelope can be made at several points in the overall process; hence, several concurrent programs include logic steps which can be executed in the event that a diversion is necessary. Logic steps involved in the diversion determination are shown in FIG. 8. Whenever it is determined at one of the processing stations that a customer's stuffed envelope should be diverted due to the occurrence of a specified condition (such as at step 490), a bit corresponding to the diversion gate associated with the specified condition is set in SBUS (step 492). In connection with the setting of the diversion bit in SBUS, an audit counter associated with that particular diversion gate is also incremented (step 494). For example, for diverter 76 the audit counter at address location 245 in non-volatile memory (see FIG. 5) is incremented.

Concurrent program STOP INTERRUPT is poised to be signalled when a stop interrupt is communicated to DPS 100. Five possible types of stops have been described hereinbefore: (1) the system stop; (2) the stop bar stop; (3) the jam stop; and, (4) the miss stop; and, (5) the double feed stop. Processing operations executed upon the occurrence of a stop interrupt are shown in FIG. 9. The receipt of a stop interrupt stops the insertion machine by disengaging the rotating shafts from the machine motor (step 502). Further, the concurrent program STOP INTERRUPT determines (at step 503) how long the machine has actually been running since its most recent start up by subtracting the value in location 360 from the value had by the calendar clock chip when the machine stopped) and adds the determined value to memory location 370 (step 504). Moreover, the calendar clock time at which the stop occurred is stored (step 506) in non-volatile location 360 as the last referenced calendar time for access and subsequent comparison upon subsequent start up.

At step 507 the concurrent program STOP INTERRUPT increments the total number of machine stops audit counter (i.e. memory location 270). The concurrent program STOP INTERRUPT also counts the occurrences of the various types of stops. The type of interrupt which occasioned the stop is determined (steps 508, 510, 512, 514, and 515) and appropriate counters are accordingly incremented (steps 516, 520, 524, 528, and 529).

Upon each stopping of the insertion machine the concurrent program STOP INTERRUPT checks (at step 530) to determine whether the operator has requested an audit trail printout. As described hereinbefore, an operator can request an audit trail printout by pressing the audit trail start button 160 located on the audit trail keyboard 157. If an audit trail printout has been requested, the concurrent program STOP INTERRUPT initiates (at step 531) the production of the printout by signalling the concurrent program REPORT GENERATION.

FIG. 10 shows processing steps conducted by the concurrent program REPORT GENERATION in the generation of an audit trail report such as that depicted in FIG. 11. At step 550 the concurrent program REPORT GENERATION obtains from non-volatile memory the contents of the audit counters in address

locations 200-299 (see FIG. 5). At step 552 the contents of selected ones of these audit counters are printed in accordance with the desired format. For the report format shown in FIG. 11, five columns of data are provided—one column for each of the time frames FRAME1-FRAME5.

At step 554 the concurrent program REPORT GENERATION obtains from volatile RAM memory addresses 389-396 (see FIG. 5A) the per document weights for the stations 42, 52-57. At step 556 the per document weights for the stations are printed in accordance with the desired format.

At step 558 the contents of the envelopes fed audit counter (i.e. the audit counter having address location 365) is loaded into a register for subsequent use as a dividend. At step 560 the contents of the audit timers are obtained from address locations 370, 375, and 380 for use in subsequent division steps.

At step 562 the contents of the register containing the number of envelopes fed (from address 365) is divided by the calendar time elapsed for FRAME1 (from address 375), and the quotient is stored in location 386 (see FIG. 5A). At step 564 the contents of location 386 is printed as the average number of envelopes per hour.

At step 566 the contents of the register containing the number of envelopes fed (from address 365) is divided by the actual run time of the machine for FRAME1 (from address 370), and the quotient is stored in location 387. At step 568 the contents of location 387 is printed as the average number of envelopes per actual machine run hour.

At step 570 the contents of address location 380 (the machine cycle count for FRAME1) is divided by the contents of address location 370 (the actual run time of the machine for FRAME1), and the quotient is stored in location 385. At step 572 the contents of location 385 is printed as the average machine cycle speed.

When an operator desires to accumulate audit counters associated with a particular time base, steps such as those depicted in FIG. 12 are executed. Upon receipt of an interrupt from one of the accumulate request keys 162 on the audit trail keyboard 157, a determination is made (steps 600, 602, 604, 608, and 612) as to which accumulation request key 162 was pressed. If it is determined at step 600 that accumulation request key 162E was pressed for FRAME5, the audit counters for FRAME5 (see FIG. 5) are initialized (step 601). If it is determined at steps 602, 604, 608, or 612 that an accumulation request key was pressed with respect to respective time frames FRAME4, FRAME3, FRAME2, or FRAME1, the contents of the audit counters associated with the selected time frame are added to the contents of the corresponding audit counters for the next higher order time frame (see steps 603, 606, 610, and 614). Also the audit counter associated with the selected time frame is initialized.

When it is determined (at step 618) that the insertion machine has been instructed to start running, the calendar timer chip is consulted (step 620) and a start calendar time is accordingly obtained. A determination is also made (at step 622) whether an accumulation has just been requested for FRAME1. If a FRAME1 accumulation was requested, the last referenced calendar time (currently stored at address 360) is subtracted at step 624 from the newly-obtained start calendar time. The result of the subtraction is added at step 626 to the fault time audit timer (address 365). Thereafter, at step 628 the newly-acquired start calendar time is stored as

the last referenced calendar time (i.e., in address 360). If a FRAME1 accumulation was not requested, step 628 is executed before further processing continues.

As described hereinbefore, an operator can request an audit printout by pressing the AUDIT TRAIL start button 160. Upon receipt of the AUDIT TRAIL printout the operator can use indications of various operating parameters in order to establish a preferred operating speed. In this respect, using the AUDIT TRAIL printout the operator can obtain the number of documents fed from the control station 42 (the "Feeder 1 Count") and the number of envelopes fed and thereby determine (by dividing the former by the latter) the average number of documents fed from the control station per customer (i.e., per group). Inasmuch as the AUDIT TRAIL printout also provides an indication of the average machine cycle speed, the operator can determine whether the average machine cycle speed is optimal in view of the average number of documents fed from the control station per customer and, if not, accordingly adjust the machine cycle speed (i.e. increase or decrease the machine cycle speed).

SECOND EMBODIMENT STRUCTURE

FIG. 1A illustrates an insertion machine according to a second embodiment of the invention. Except as may otherwise be noted herein, non-data processing structural aspects of the embodiment of FIG. 1A basically resemble and bear the same reference numerals as corresponding structures of the FIG. 1 embodiment. In the embodiment of FIG. 1A, a first data processing system (DPS1) 100', which corresponds to the DPS 100 of the embodiment of FIG. 1, is connected to a second data processing system (DPS2) 700 by a shielded, 37-conductor cable 702. It is hereinafter understood that the embodiment of FIG. 1A primarily differs from the embodiment of FIG. 1 by the addition of the DPS2 700 and various peripheral devices associated therewith; by the modification of the collection of concurrent programs executed by the DPS1 100' to reflect the addition of the DPS2 700; and, by the particular program and subroutines executed by the DPS2 700.

The DPS2 700 comprises a computer such as that marketed by International Business Machines, Inc. as model PCXT. It should be understood that other models, such as the PCAT, for example, are used in other embodiments, and that other types of computers can be used to carry out the functions of the DPS2 700.

As illustrated in FIG. 13, the DPS2 700 of the embodiment of FIG. 1A has a housing 704 wherein are located a motherboard (represented by broken lines 706) having a backplane region shown generally as 708; a power supply 710; a clock 711; first storage medium drive means (such as floppy disc drive 712); and, a second storage medium drive means (such as hard disc drive 714). As seen hereinafter, the DPS2 700 is connected to peripheral devices including a printer 716; a video display device such as a cathode ray tube (color monitor 718); and, a keyboard 720.

The configuration of the motherboard 706 and the backplane region 708 is understood by those skilled in the art. In this regard, the motherboard 706 has a microprocessor (shown by broken lines 722) and non-volatile RAM memory (shown generally by broken line 724) mounted thereon. The backplane region 708 comprises card slots J1 through J8. An I/O chip-connected trace on the motherboard 706 is connected by a cable 728 to the keyboard 720.

An enhanced graphics card 730 such as that marketed as Screenware Graphics Adapter by Computer Technology Corporation is mounted in slot J1. The enhanced graphics card 730 is connected via a suitable cable 732 to the monitor 718.

An expanded memory card 734 such as model AST6-PAK marketed by Quadram Corporation is mounted in slot J2. The expanded memory card 734 includes a non-volatile calendar clock.

An input/output (I/O) card 738 such as a 24 bit, parallel I/O card marketed by METRABYTE as model PI012 is mounted in card slot J3. I/O card 738 has a parallel printer interface which is connected by a cable 739 to the pointer 716. A terminal associated with card 738 is connected by a cable 740 to a terminal associated with an I/O interface card 740 mounted in slot J4.

The I/O interface card 740 mounted in slot J4 serves to convert voltage and current levels between the DPS1 100' and the DPS2 700. In this respect, voltage levels in the DPS1 100' (using a TI 9995 microprocessor) are CMOS, while voltage levels in the DPS2 700 are TTL. The shielded, 37-conductor cable 702 connects the I/O interface card with the I/O means comprising the DPS1 100'.

Other cards mounted in the backplane region 708 include a hard disc control card 744 in slot J5; a floppy disc control card 746 in slot J6; and, a communications card 748 in slot J8. Card 744 is connected to the hard disc drive 714 by a cable 750 while card 746 is connected to the floppy disc drive 712 by a cable 752.

As explained more fully hereinafter, the DPS1 100' and DPS2 700 communicate via cable 702 using a handshaking technique whereby the DPS1 100' (also known as the "95" in view of the TI 9995 microprocessor employed in one embodiment) sends 95-TO-PC COMMANDS to the DPS2 700 (also known as the "PC"), and whereby the DPS2 700 sends PC-TO-95 COMMANDS to the DPS1 100'. Each command is in the form of a plurality of bytes of information with the first byte of the command being a command number; and the second byte of the command being a value representative of the total number of bytes comprising the command; all but the last of the remaining bytes of the command being formatted to contain information according to pre-arranged specification which is related to the particular command number (see Charts 1 and 2); and, the last byte of the command containing a checksum value. Thus, the format of each command is generally as follows:

byte 1—command number
byte 2—number of bytes (N)
byte 3—data 1
byte N—data N-2
byte N+1—checksum

Some of the PC-TO-95 COMMANDS are used for downloading values for machine operating parameters. These downloading commands are generated essentially in response to user input via keyboard 720 as prompted by hereinafter-described appropriate displays on the monitor 718. In this regard a PC-TO-95 COMMAND 1 is used to download integer values which specify for each of as many as 16 possible standard gripper-type insert stations whether the stations is in the ON mode, OFF mode, SELECT mode, or SELECTIVE MERCHANDISING mode (i.e., contains third party advertising documents). A PC-TO-95 COMMAND 3 is used to download per item weight values for (1) envelopes at the envelope stations; (2) documents

stored at each of as many as 16 possible standard gripper-type insert stations; and (3) long and short documents stored at each of as many as six possible system stations (i.e., feeder stations including reading stations which are not standard gripper-type stations). A PC-TO-95 COMMAND 4 is used to download values indicative of the maximum number of documents that are allowed to be fed from various insert processing stations. A PC-TO-95 COMMAND 5 is used to download indications regarding selected modes in which various system stations are to operate (for example, whether the system stations are to be operated in a READ, NON-READ, or OFF mode; and, if in a READ mode, whether a particular sub-mode and a MATCH mode are utilized). A PC-TO-95 COMMAND 7 is used to download timing information values indicative of machine cycle degree points including points (1) at which a system is to start feeding; (2) at which a collector is to deposit or dump its sub-group of documents onto the insert track; (3) at which an OVERRIDE mode can be entered. A PC-TO-95 COMMAND 12 is used to download values indicative of a plurality of miscellaneous switch settings such as, for example, (1) a switch which controls the enablement of a package sealing station; and (2) a switch which determines whether a demand feed is to occur upon the presence or absence of a mark in a particular location in an indicia field on a control document.

Under normal insertion machine operation conditions some of the PC-TO-95 COMMANDS are used to interrogate the DPS1 100' for obtaining therefrom machine-related output data. These interrogating commands are also generated in response to user input via the keyboard 720 as prompted by appropriate hereinafter-described displays on the monitor 718. In this regard, a PC-TO-95 COMMAND 9 requests the DPS1 100' to provide output data relative to a group of documents situated at a specified track location on the insert track. A PC-TO-95 COMMAND 10 requests the DPS1 100' to provide output data relative to a particular specified modular device (such as a cutter, a burster, an accumulator, or a collector) at a specified modular station.

At least one of the 95-TO-PC COMMANDS is used to respond to a PC-TO-95 COMMAND which is of the interrogatory type. In this regard, a 95-TO-PC COMMAND 9 is used to provide the output data (relative to a particular modular device) sought by a PC-TO-95 COMMAND 10.

Some of the 95-TO-PC COMMANDS are generated once every machine cycle. In this regard, the 95-TO-PC COMMAND 1 provides output data relative to the group of documents at two specified track locations, as well as output data relative to (1) whether each of as many as 16 possible standard gripper-type stations fed a document during the current machine cycle; and (2) the number of documents fed from each of as many as six possible reading or system stations during the current machine cycle; and, (3) whether a chargeback was triggered for each of as many as 16 possible standard gripper stations during the current machine cycle. The 95-TO-PC COMMAND 11 is generated possibly as frequently as once each machine cycle to provide output data reflecting whether each of as many as 16 possible standard gripper-type stations were allowed to feed a document during the machine cycle.

Various others of the 95-TO-PC COMMANDS are generated upon the occurrence of a particular condition in the insertion machine. In this regard, a 95-TO-PC

COMMAND 2 is generated when the insertion machine stops (i.e. when the concurrent program MMONITOR indicates that machine running line 136 has gone from a low to a high). A 95-TO-PC COMMAND 3 is generated when an insertion machine fault (including such fault types as a read error and a parity error) has been detected. A 95-TO-PC COMMAND 4 is generated to acknowledge that an operator has corrected a condition that prompted the generation of a 95-TO-PC COMMAND 3. A 95-TO-PC COMMAND 12 is generated when the DPS1 100' is powered up; a 95-TO-PC COMMAND 13 is generated when the DPS1 100' crashes. A 95-TO-PC COMMAND 14 is generated every $\frac{1}{2}$ second when the insertion machine is not running and provides output data relative to a group of documents at specified insert track location.

Two 95-TO-PC Commands concern an OVERRIDE condition that can occur in the insertion machine. The OVERRIDE condition is entered when it is determined that a system station, some types of which can feed a plurality of documents per machine cycle, requires more than one machine cycle in order to completely feed all documents associated with a group onto the insert track 30. In such a case the rotating main timing shaft and the intermittently rotating shaft are decoupled from the insertion machine motor, thereby permitting the insert track 30 to remain essentially stationary as long as is necessary for the system station to feed all related documents onto the insert track 30 at the location whereat the previously-fed documents belonging to the group are situated. The OVERRIDE condition occurs when a detector or reading device at an insert feeder station such as a control station detects an appropriate indication in indicia on a fed document. When the OVERRIDE condition is entered a 95-TO-PC COMMAND 5 is generated, when the OVERRIDE condition is exited a 95-TO-PC COMMAND 6 is generated.

Two 95-TO-PC COMMANDS concern a DEMAND FEED condition that can occur in the operation of the insertion machine. The DEMAND FEED condition is entered when it is determined that a reading gripper-type station, which feeds one document per machine cycle, requires another machine cycle in order to feed therefrom a second document to be associated with a group currently before the reading gripper station on the insert track 30. In such a case, while the machine's main timing shaft continues to rotate, the insert track is decoupled from its intermittently rotating drive shaft for one machine cycle, thereby permitting the insert track 30 to remain essentially stationary for another machine cycle so that the reading gripper station can feed another document onto the insert track 30 at the location whereat the group is situated. The DEMAND FEED condition occurs when a detector or reading device detects an appropriate indication in indicia on a fed document. Depending upon how a DEMAND FEED switch is set, the DEMAND FEED condition can be triggered upon the detected presence or absence of a mark in a predetermined position in an indicia field. When the DEMAND FEED condition is entered a 95-TO-PC COMMAND 7 is generated. When the DEMAND FEED condition is exited a 95-TO-PC COMMAND 8 is generated.

A 95-TO-PC COMMAND 10 is generated when an ALERT AND CLEAR condition is entered. An ALERT AND CLEAR condition occurs when the control station, which has been feeding documents included in a first job or batch, determines (as by indicia

on a control card) that the next documents to be fed therefrom are to be included in a second job or batch. Upon the occurrence of the ALERT AND CLEAR condition the second batch of documents are held up at the control station while the last groups included in the first batch are indexed down the insert track 30. A PC-TO-95 COMMND is generated by the DPS2 700 when an ALERT AND CLEAR RESET condition is entered.

The format of the commands 95-TO-PC COMMANDS 1-15 and PC-TO-95 COMMANDS 1-12 is understood with reference to the following charts:

CHART 1: 95-TO-PC COMMANDS

COMMAND 1 - Process bus and status data		
command no.	1	
number of bytes	44	
data 1	bus track location	
data 2	bus image for location specified at data 1	
—	—	
—	—	
data 16	—	
data 17	bus image for last track location	
—	—	
—	—	
data 31	status, stations env, gripper 1-16	
data 32	status, gripper stations 7-14	
data 33	status, gripper stations 15-16	
data 34	status, gripper stations 15-16	
data 35	piece count, feeder (system station) 1	
—	—	
—	—	
—	—	
data 40	piece count, feeder (system station) 6	
data 41	chargeback status, stations 1-8	
data 42	chargeback status, stations 9-16	
COMMAND 2 - Stopped mode		
command no.	2	
number of bytes	2	
***no data**		
Command 3 - Faulted Mode		
command no.	3	
number of bytes	13	
data 1	fault type	
data 2	station id	
data 3	device id	
data 4	channel id (1 or 2)	
data 5	command 4 required (0=false, 1=true)	
data 6,7	(integer 1)	
data 8,9	(integer 2)	
data 10, 11	(integer 3)	
Fault Type		
Type	Description	Fault Data
1	station-station mismatch	int 1 = track match data int 2 = station match data int 3 = error count
2	instation mismatch	int 1 = set match int 2 = piece match data
3	"flashing mismatch"	int 1 = track match data int 2 = station mach data
4	read error	
5	parity error	
6	alert & clear stop	
7	high count stop	int 1 = piece count
8	overweight stop	int 1 = weight
9	override timeout	
10	mode error	
COMMAND 4 - Error acknowledge		
command no.	4	
number of bytes	5	
data 1	fault type (see above)	
data 2	station id	
data 3	channel id	
Command 5 - Enter OVERRIDE		
command no.	5	

-continued

number of bytes	3	
data 1	station id	
COMMAND 6 - Exit OVERRIDE		
command no.	6	
number of bytes	3	
data 1	station id	
COMMAND 7 - Enter DEMAND FEED		
command no.	7	
number of bytes	3	
data 1	station id	
COMMAND 8 - Exit DEMAND FEED		
command no.	8	
number of bytes	3	
data 1	station id	
COMMAND 9 - Device Information		
command no.	9	
number of bytes	60	
data 1	device command register image	
—	—	
—	—	
—	—	
data 56	—	
data 57	station id	
data 58	device id	
COMMAND 10 - Enter ALERT AND CLEAR State		
command no.	10	
number of bytes	3	
data 1	station id	
COMMAND 11 - Station Control Switch Status		
command no.	11	
number of bytes	18	
data 1	switch status, station 1 (0=ON, 1=OFF)	
data 2	switch status, station 2	
—	—	
—	—	
—	—	
data 16	switch status, station 16	
COMMAND 12 - 9995 Powered Up		
command no.	12	
number of bytes	2	
***no data**		
COMMAND 13 - 9995 Crashing		
command no.	13	
number of bytes	4	
data 1	crash code	
data 2	reason code	
COMMAND 14 - Stopped Mode Bus Data		
command no.	14	
number of bytes	18	
data 1	bus track location	
data 2	first byte of bus image for location specified at data 1	
—	—	
—	—	
—	—	
data 16	last byte of bus image	
COMMAND 15 - Feed Complete Information		
command no.	15	
number of bytes	6	
data 1	station id	
data 2	device id	
data 3	channel	
data 4	status (0=false, 1=true)	
CHART 2: PC-TO-95 COMMANDS		
COMMAND 1 - Download station control info		
command no.	1	
number of bytes	18	
data 1	station 1 (1=OFF, 2=ON, 3=SELECT, 4=SELECTIVE MERCHANDISING)	
data 2	station 2	
—	—	
—	—	
—	—	
data 16	station id	
COMMAND 2 - Error Clear		
command no.	2	
number of bytes	3	

-continued

data 1	fault type
<u>COMMAND 3 - Download Weighing Info</u>	
command no.	3
number of bytes	60
data 1,2	envelope weight
data 3,4	station 1 weight
—	—
—	—
data 33,34	station 16 weight
data 35,36	feeder 1 weight
—	—
—	—
data 45,46	feeder 6 weight
data 47,48	feeder 1 longcheck weight
—	—
—	—
data 57,58	feeder 6 longcheck weight
<u>COMMAND 4 - Download System Piece Counts (TWLs)</u>	
command no.	4
number of bytes	12
data 1	count 1
data 2	count 2
—	—
—	—
data 10	count 10
<u>COMMAND 5 - Download System Mode Info</u>	
command no.	5
number of bytes	5
data 1	system mode (4=READ, 2=NON-READ 1=OFF)
data 2	system submode (1, 2, 4, 8, 16, etc.)
data 3	match mode (0=OFF, 1=ON)
<u>COMMAND 6 - System Clear Entered</u>	
command no.	6
number of bytes	2
no data	
<u>COMMAND 7 - Download Timing Info</u>	
command no.	7
number of bytes	5
data 1	feeder start time (degree/10)
data 2	collector dump time (degree/10)
data 3	override time (degree/10)
<u>COMMAND 8 - Hard Fault Machine</u>	
command no.	8
number of bytes	2
no data	
<u>COMMAND 9 - Download Track Location (for display)</u>	
command no.	9
number of bytes	3
data 1	track location
<u>COMMAND 10 - Download Modular Device id</u>	
command no.	10
number of bytes	4
data 1	station id
data 2	device id
<u>COMMAND 11 - Alert and Clear Reset Entered</u>	
command no.	11
number of bytes	2
no data	
<u>COMMAND 12 - Misc. Switch Status</u>	
command no.	12
number of bytes	12
data 1	switch 1 status
—	—
—	—
data 10	switch 10 status

In order to permit the DPS1 100' to generate the 95-TO-PC COMMANDS and to interpret and respond to the PC-TO-95 COMMANDS, the collection of concurrent programs executed by the DPS1 100' of the embodiment of FIG. 1A differs in several primary respects from the collection executed by the DPS 100 of

the embodiment of FIG. 1. As a first difference, the collection executed by the DPS1 100' includes the additional concurrent process IBM_PC, and several concurrent processes (the most notable of which are PC_INT; PC_PERIOD; and PC_OPR).

As seen hereinafter with respect to FIG. 15, concurrent process IBM_PC (including even-numbered execution steps 802-822) essentially initializes several semaphores (steps 802-806); starts the concurrent execution of the processes PC_INT; PC_PERIOD; and PC_OPR (steps 810-814); and, transmits a 95-TO-PC command including data in an output buffer SENDBF when a semaphore PCSEND is signalled (step 820). As seen hereinafter with respect to FIG. 16, concurrent process PC_INT (including even-numbered execution steps 830-902) essentially manages the receipt and handling of the PC-TO-95 COMMANDS. As seen hereinafter with respect to FIG. 18, the concurrent process PC_PERIOD (including even-numbered execution steps 910-932) is used to generate various 95-TO-PC COMMANDS whose generation is dependent upon insertion machine timing. As seen hereinafter with respect to FIG. 17, the concurrent process PC_OPR (including even-numbered execution steps 940-980) is used to generate various other 95-TO-PC COMMANDS.

Upon the generation of their 95-TO-PC COMMANDS, the concurrent processes PC_PERIOD and PC_OPR, as well as other processes and procedures described herein, signal the semaphore PCSEND, thereby enabling program IBM_PC to transmit the 95-TO-PC COMMANDS to the DPS2 700. FIG. 14 shows the concurrent programs which signal the semaphore PCSEND in order to initiate transmission of 95-TO-PC COMMANDS and the particular 95-TO-PC COMMAND numbers associated therewith. It should be understood that in other embodiments the semaphore PCSEND is signalled by other concurrent programs. For example, although the FIG. 1A embodiment has only one system station (i.e. station 42), in other embodiments having a plurality of system stations each system station has associated therewith a concurrent program with procedures and concurrent processes which signal the semaphore PCSEND in like manner as that shown in FIG. 14. Likewise, in an embodiment having reading gripper stations, in connection with the DEMAND FEED mode a concurrent program associated with the reading gripper station signals the semaphore PCSEND in connection with the generation of 95-TO-PC COMMAND 7 and 95-TO-PC COMMAND 8.

A second difference in the collection of concurrent programs executed by the DPS1 100' of the embodiment of FIG. 1A as compared to the DPS 100 of the embodiment of FIG. 1 is the inclusion of additional instructions in the concurrent programs and processes associated with various processing stations at which processing events of interest occur. These additional instructions are essentially configured to load machine-related diagnostic data of interest into the output buffer SENDBF and to signal the semaphore PCSEND and PCSEND. Signalling the semaphore PCSEND enables the concurrent program IBM_PC to transmit an appropriate 95-TO-PC COMMAND as described above.

A third difference in the collection of concurrent programs executed by the DPS1 100' is the allocation of additional memory workspace locations in RAM memory for use in connection with the logic implemented as a result of the inclusion of additional concurrent pro-

grams and the inclusion of additional instructions to other concurrent programs. A chart of variable identifier names including names which corresponding to various RAM memory locations referenced in the ensuing discussion of operation follows as Chart 3.

CHART 3	
IDENTIFIER	USAGE/TYPE
ACREST	Alert and Clear Reset Entered - Boolean
CBCNTS	Chargeback Count - Array (32 elements)
DEVID	Modular Device Id - Integer
DMPTIM	Collector Dump Time - Integer
ERRCLR	All Errors Cleared by PC - Boolean
FDCRNT	Feeder Count of Documents Fed - Array (6 elements)
GSXCHG	Station Programmed Control Array Change Flag - Boolean
GSXCON	Station Program Control - Array (18 elements)
LASTTRAK	Last Track Position on Insert Track - Integer
MATTMP	Match Mode Pending - Integer
OVRTIM	Feeder Override Time - Integer
RUNNIN	Machine Running Flag - Boolean
SENDBF	Command Output Buffer Array - (32 elements)
STAIID	Station Id - Integer
STAT	Station Status Array - (12 elements)
STRTIM	Feeder Start Time - Integer
SUBTMP	System Sub-Mode Pending - Integer
SWVAL	Switch Values Array - (10 elements)
SYSTMP	System Mode Pending - Integer
TRKLOC	Selected Track Position on Insert Track - Integer
TWLVAL	Station Piece Counts Array (10 elements)
WEIGHT	Station Weight - Array

The DPS2 700 has stored on the hard disc in disc drive 714 a program PC Manager 1006 and a plurality of associated subroutines whereby the DPS2 700 executes operational steps. The primary subroutine included in the program residing on the hard disc are shown in FIG. 19 as including an Input Driver 1002; 95-TO-PC COMMAND Interpreter 1004 (also known as CMDINTR); a PC Manager File 1006; Screen Selector 1008 (also known as STREAM); PC-95-TO Command Formatter 1010; Output Driver 1012; and AUDIT_TRAIL_PROCESSING 1014; Screen Generator 1016; Hard Disc Drive Handler 1018; Floppy Disc Drive Handler 1020; Printer Handler 1022; and, Keyboard Handler 1024. In the illustrated embodiment the program residing on the hard disc in drive 714 is in the "C" programming language. FIG. 20 illustrates the execution steps 1050-1168 associated with the 95-TO-PC COMMAND Interpreter 1004.

Associated with the program PC Manager 1006 are a plurality of global identifiers used as AUDIT TRAIL counters and AUDIT TRAIL timers. The nature of the audit timers for the embodiment of FIG. 1A are essentially of FIG. 1. Among the AUDIT TRAIL counters maintained by the DPS2 700 for the insertion machine configuration of embodiment of FIG. 1A are those set forth on Chart 4:

CHART 4	
AUD_CNT_ENV[X]	# of envelopes fed
AUD_CNT_STA[X][1]	# of documents fed from 1st standard gripper
.	.
.	.
AUD_CNT_STA[X][6]	# of documents fed from 6th

-continued

CHART 4

5	AUD_CNT_FDR[X][1]	standard gripper # of documents fed from control station
	AUD_CNT_CHGBK[X][1]	# of chargeback documents 1st standard gripper
	AUD_CNT_CHGBK[X][6]	# of chargeback documents 6th standard gripper
10	AUD_CNT_DVTR[X][1]	# of documents diverted by 1st diverter
	AUD_CNT_DVTR[X][2]	# of documents diverted by 2nd diverter
	AUD_CNT_MTR[X][1]	# of envelopes metered by 1st meter
15	AUD_CNT_MTR[X][2]	# of envelopes metered by 2nd meter
	AUD_CNT_WTCTG[X][1]	# of documents in first weight category
.	.	.
20	AUD_CNT_WTCTG[X][5]	# of documents in fifth weight category

In Chart 4 with X=0 corresponds to a "temporary" counter for the current work shift; X=1 corresponds to an actual counter for the current work shift.

With further reference to Chart 4, it should be understood that the number of standard gripper stations and the number of system stations varies from configuration to configuration. Although the number of system stations and the number of standard gripper stations shown in the configuration of FIG. 1A are 1 and 6, respectively, as many as 6 system stations and 16 gripper stations can be included in an embodiment. In view of the particular configuration of FIG. 1A, the value of a memory location NM_GRIPPERS (representing the number of standard gripper stations) is set equal to "6"; the value of a memory location NM_FEEDERS (representing the number of system stations) is set equal to "1".

Under the control of the PC Manager 1006 the Screen Generator 1016 generates a plurality of screen displays on monitor 718 including those having names shown in the rectangular symbols of FIG. 21. FIG. 21 further illustrates the 95-PC-95 COMMANDS which prompt generation of the screen displays and/or the PC-TO-95 COMMANDS generated in response to input (via keyboard 720) prompted by the screen displays. FIG. 22 depicts the appearance of various ones of the screen displays which are displayed on monitor 718.

Coded instructions included in the PC Manager 1006 and the hard disc handler subroutine 1018 are configured to permit the DPS2 700 to manage a plurality of AUDIT TRAIL files maintained on the hard disc in disk drive 714. The AUDIT TRAIL files maintained on the hard disc are shown in FIG. 24 and include twenty one "shift" files named SHIFT1, SHIFT2, . . . SHIFT 21; five "week" files named WEEK1, WEEK2, . . . WEEK5; four "month" files named MONTH1, MONTH2, . . . MONTH4; four "quarter" files named QUARTER1, QUARTER2, . . . QUARTER4; and, a "year" file named YEAR. Also maintained on the non-volatile hard disc are pointers which point to the appropriate ones of the AUDIT TRAIL files being utilized at any given moment. These pointers are SHIFT_FILE_POINTER; WEEK_FILE_POINTER; MONTH_FILE_POINTER; and, QUARTER_FILE_POINTER.

Second Embodiment Operation

Six sequential steps are followed to start-up the insertion machine system of the embodiment of FIG. 1A. It is assumed that, prior to these steps, the appropriate documents have been loaded into hoppers associated with the feeder stations and gripper-type insert stations, and that appropriate envelopes have been loaded into the envelope hopper associated with the envelope station 50.

As a first step, the DPS2 700 is powered up with the hard disc drive handler 1018 utilized to load the program on the hard disc into the RAM memory 724. In this respect, the instructions loaded into RAM 724 include at least portions of the program PC Manager 1006 and its subroutines as shown in FIG. 19. As the program PC Manager begins execution, several initializing steps occur. Included in the initialization process are several initializing steps which pertain to the AUDIT TRAIL mode. As a first such step, the clock 711 is initialized at the time currently indicated by the non-volatile calendar clock on the expanded memory card 734. As a second such step, the AUDIT TRAIL "temporary" counters which will be used for maintaining statistical counts during the forthcoming batch or run are initialized. The "temporary" counters are those which are dimension "[0]", and whose contents are loaded into corresponding counters dimensioned as "[1]" when AUDIT TRAIL output operations (such as display, accumulation, or report generation) are requested with reference to the current work shift.

As a second step in the start up of the insertion machine system, both the insertion machine and the DPS1 100' are powered up so that the DPS1 100' can execute the collection of concurrent programs included in its software system.

Describing now in further detail some of the processing steps which occur shortly after powering up the DPS1 100', a concurrent program GENESIS similar to that described in the embodiment of FIG. 1 is initially executed. In addition, the execution of the concurrent program IBM_PC begins. Upon beginning execution the concurrent program IBM_PC initializes the semaphore BUFAVL (step 802); the semaphore PCSEND (step 804); and, the semaphores PCCMD(1), PCCMD(2), . . . PCCMD(15) (step 806). The semaphore BUFAVL is used to indicate whether an output buffer SENDBF is available for loading with data. The semaphore PCSEND is signalled when one of the concurrent programs, processes, or procedures shown in FIG. 14 has prepared a 95-TO-PC COMMAND for transmission to the DPS2 700. The semaphores PCCMD(1) through PCCMD(15) are associated with respective 95-TO-PC COMMANDS 1 through 15, with in appropriate one of the semaphores being signalled when its corresponding command has been prepared.

In addition to initializing semaphores, during its initial execution the concurrent program IBM_PC at steps 810, 812, and 814 starts the execution of the three concurrent processes PC_INT; PC_PERIOD; and, PC_OPR. After being started, these three concurrent processes, along with the concurrent program IBM_PC and other concurrent programs and processes such as those described with reference to the embodiment of FIG. 1, are independently executing under the control of the multitasking operating system of DPS1 100'.

As a third step in the start-up of the insertion machine, the DPS1 100' transmits a 95-TO-PC COMMAND 12 to the DPS2 700. In this regard, the concurrent process PC_OPR, which was started at step 814 of the concurrent program IBM_PC, begins its execution at step 940 by signalling the semaphore PCCMD(12) to indicate the start up of the DPS1 100'. At step 942 the semaphore PCSEND is signalled. The concurrent process PC_OPR then suspends its execution by the delay step 944. Signalling of the semaphore PCSEND causes the concurrent program IBM_PC to resume its execution inasmuch as such a signal had been awaited at step 816. The concurrent program IBM_PC at step 818 puts the number of bytes associated with a 95-TO-PC COMMAND 12 into byte 2 of the buffer SENDBF. At step 820 the concurrent program IBM_PC supervises the transmission of the PC-TO-95 COMMAND 12 using the contents of the buffer SENDBF. In this respect, a conventional handshaking transmission of the command occurs from the DPS1 100' to the DPS2 700. Subsequent to transmission, at step 822 the semaphore BUFAVL is signalled to indicate that the output buffer is available.

As a fourth step in the start-up of the insertion machine, upon receipt of the 95-TO-PC COMMAND 12 the DPS2 700 displays the screen display MAINMENU of FIG. 22A on the monitor 718. In this regard, upon receipt of the 95-TO-PC COMMAND 12 by the input driver 1002 of the DPS2 700, the command interpreter (CMDINTR) 1004 obtains the command number (at step 1050) and, using its switch instruction, sets a flag PWR_UP_95 at step 1158. Under the control of the PC Manager 1006 the screen selector (STREAM) 1008 determines that the screen display MAINMENU should be displayed. Accordingly, under the control of the PC Manager 1006, the screen generator 1016 generates the display shown as FIG. 22A.

As a fifth step in the start-up of the insertion machine, various types of operating input parameters are downloaded from the DPS2 700 to the DPS1 100'. In general, to download input operating parameters the screen display MAINMENU (FIG. 22A) is used to select for display on monitor 718 an appropriate screen display associated with the parameter-to-be-downloaded. The screen display associated with the parameter prompts the user to supply via the keyboard 720 an appropriate input value or setting as the operating parameter. Supervising the keyboard handler 1022 as well as the formatter 1010 and the output driver 1012, the PC Manager 1006 causes the output driver 1012 to generate an interrupt and, using the keyboard input data, a PC-TO-95 COMMAND of the downloading type. In this respect, the PC manager instructs the PC-TO-95 command formatter 1010 to prepare a new PC-TO-95 COMMAND which includes indicative of the keyboard input. The PC manager directs the output driver 1012 to transmit to the DPS1 100' an interrupt; a data available signal; and, when the DPS1 100 is ready, the PC-TO-95 COMMAND. The DPS1 100' awaits the interrupt (by the signalling of semaphore PCINT at step 830) in accordance with conventional handshaking techniques. As governed by the concurrent process PC_INT, the command number is used in connection with a Microprocessor Pascal TM language "CASE" instruction (even numbered steps 836 through 858) to determine how the 95-TO-PC command is to be processed.

A first type of insertion machine input parameter downloaded from the DPS2 700 to the DPS1 100' is

control information for each of the standard gripper-type stations, such as stations 52 through 57. For each such gripper station the DPS1 100' must know whether the gripper stations is in the ON mode, the OFF mode, the SELECT mode, or the SELECTIVE MERCHANDISING mode. In this respect, the DPS1 100' has in its RAM memory an array GSXCON with each standard gripper station having a corresponding associated location in the array GSXCON. The value stored in the corresponding location in array GSXCON for a gripper station determines the mode in which the gripper station operates. In this respect, a "1" value is indicative of the OFF mode; a "2" value is indicative of the ON mode; a "3" value is indicative of the SELECT mode; and, a "4" value is indicative of the SELECTIVE MERCHANDISING mode. It should be understood that an insertion machine may include in its configuration a smaller number of standard gripper-type arm stations than that for which the array GSXCON is dimensioned, and accordingly that some element locations in the array GSXCON may not be utilized for such configurations.

In order to download the station control information, the operator (viewing on the color of monitor 700A the display screen MAINMENU of FIG. 22A) presses the "F3" key on the keyboard 720. Actuation of a key on the keyboard 720 is noted by the keyboard handler 1024 which, under control of the PC Manager 1006, transmits an indication of the key pressed to the PC Manager 1006. On the basis of the pressing of the "F3" key, the PC Manager 1006 instructs the screen generator 1016 to display the screen display STASELCO which is shown in FIG. 22B. It is henceforth understood that changes of various screen displays in response to input on the keyboard 720 is accomplished by similar steps.

The screen display STASELCO of FIG. 22B permits the user to indicate for each standard gripper station (such as stations 52 through 57) in an insertion machine configuration whether the station is in the ON mode, the OFF mode, the SELECT mode, or the SELECTIVE MERCHANDISING mode. In this respect, the particular screen display STASELCO of FIG. 22B concerns an embodiment in which six gripper stations are provided, and wherein keys "F3" and "4" are utilized to determine which of the gripper stations is affected while the key "F6" is used to scroll through the mode settings.

With reference to the screen display STASELCO of FIG. 22B, two actions are taken each time a key on the keyboard 720 is pressed. As a first action, a value indicative of the mode to which the mode arrow of FIG. 22B points (whether a "1" value [OFF mode], a "2" value [ON mode], etc) for the station pointed to by the station arrow is stored in RAM 724. As a second action, the PC Manager 1006 instructs the formatter 1010 to prepare a new PC-TO-95 COMMAND 1 using the stored values. The new PC-TO-95 COMMAND 1 is output from the DPS2 700 via the output driver 1012 which handles the handshaking and downloading to DPS1 100'. The operator uses screen display STASELCO in this manner in order to download input-parameters for each of the gripper-type stations included in the particular insertion machine configuration.

The interrupt associated with the PC-TO-95 COMMAND 1 causes the concurrent program PC_INT to resume its execution (since the concurrent process PC_INT had been waiting on the interrupt at step 830). After reading the PC-TO-95 COMMAND from the

DPS2 700 at step 832, the concurrent process PC_INT determines the command number and branches to an appropriate instruction address in accordance with the command number. Thus, having determined at step 836 that a PC-TO-95 COMMAND 1 was received, at step 860 the concurrent process PC_INT loads the downloaded control information for each gripper station included in the PC-TO-95 COMMAND 1 into the array GSXCON. In this manner, as a plurality of PC-TO-95 COMMANDS 1 are received, an appropriate location in the array GSXCON is eventually filled with an operator-input value indicative of the control mode for that gripper station for the forthcoming batch. After receipt of each PC-TO-95 COMMAND 1 the current process PC_INT then loops back to await a further interrupt process at step 830.

Another type of operating input parameter that must be downloaded from the DPS2 700 to the DPS1 100' is the per document weight of documents at each insert feeding station (both gripper-type stations and system stations), as well as the per envelope weight for envelopes at the envelope station 50. In order to download these per document weights when viewing the screen display MAINMENU on the monitor 718, the operator selects the key "F4" on the keyboard 720. In response to the "F4" key input the PC Manager 1006 causes screen generator 1016 to generate a display screen WEIGHMEN on the monitor 718. Although not illustrated herein, the display screen WEIGHMEN is understood to be a menu which allows the operator to select one of three further screens: display screen CHANGWGHT (shown in FIG. 22C); display screen CNTDISPL (shown in FIG. 22D); and, display screen TOTWGT (unillustrated).

Using the menu of screen WEIGHMEN the operator presses a key on keyboard 720 which ultimately causes the screen generator 1016 to generate display screen CHNGWGHT on the monitor 720. Using these function keys on the keyboard 720 as designated by the screen display CHNGWGHT, the operator can select a station (either a system station, a standard gripper-type station, or the envelope station) for which a per document weight is to be entered. In this respect, it is understood that the operator can enter a per document weight for each station on a station-by-station basis. In this respect, for each system feeder station two per document weights can be entered—a nominal (i.e. short document per document weight for a document type having a first weight-influencing characteristic and a "long check" weight for a document type having a second weight-influencing characteristic. The per document weights are input using a numeric pad portion of the keyboard 720 with keys 0 through 9.

Each time a numeric key is pressed while CHANGWGHT is being displayed, two actions are taken. First, a new numeric value for the station being displayed is entered into RAM 724. Second, the PC Manager 1006 instructs the formatter 1010 to prepare a PC-TO-95 COMMAND 3 which, as understood with reference to Chart 2 provided above, includes the per document weights for all stations as currently stored in the RAM 724. In a manner understood from the preceding discussion, the PC-TO-95 COMMAND 3 and its associated interrupt are transmitted by the output driver 1012 to the DPS1 100'.

Upon receipt of the interrupt associated with the PC-TO-95 COMMAND 3, the concurrent process PC_INT at step 830 resumes its execution and reads the

PC-TO-95 COMMAND 3 from the DPS2 700. Using its "CASE" instruction at step 840 the concurrent process PC_INT branches to an appropriate instruction location depending on the command number. For this command, the execution jumps to step 866. At step 866 the downloaded per envelope weight information is moved into a corresponding location in an array WEIGHT. It is understood that memory locations for the array WEIGHT are located in RAM and resemble locations 389 through 396 as described in the embodiment of FIG. 1. At step 868 the downloaded per document weight information for each standard gripper-type station is moved into a corresponding location in the array WEIGHT. At step 870 the nominal (i.e., short document) per document weight information is loaded into a corresponding location in the array WEIGHT for each system feeder station. Likewise, at step 872 the downloaded longcheck per document weight information for each feeder station is moved into a corresponding location in the array WEIGHT. Thereafter, the concurrent process PC_INT resumes waiting at step 830 upon the next signalling of semaphore PCINT.

Another type of operating input parameter that must be downloaded from the DPS2 700 to the DPS1 100' is a value to be stored in location TRAKLOC as a designation as to which physical track location along the insert track 30 is to serve as a track locator reference point. As is explained in U.S. patent application Ser. No. 707,124 filed Feb. 28, 1985, each processing station along the insert track 30 is assigned a position location number relative to an origin-serving processing station. As will be seen hereinafter, 95-TO-PC COMMANDS 1 are generated every machine cycle, each 95-TO-PC COMMAND 1 including therein data including portions of two records from SBUS. The two records in SBUS for which data is included in a PC-TO-PC COMMANDS contain data relative to groups of documents being processed at that moment at two physical locations on the insert track 30. In response to a prompt seen on the screen display TRACKINFO, the operator can enter on the numeric pad of keyboard 718 a value which represents the first of the two physical track locations of insert track 30 for which data from a record in SBUS is to be included in a 95-TO-PC COMMAND 1. Upon the pressing of a numeric key in response to the prompt of display TRACKINFO, the PC Manager 1006 requires the command formatter 1010 to generate a PC-TO-95 COMMAND 9 containing in its third byte the value to be downloaded into memory location TRKLOC of the DPS1 100'. Upon transmission of the PC-TO-95 COMMAND 9 the concurrent process PC_INT at step 892 stores the downloaded third byte of the command into location TRKLOC. In the example under discussion for the embodiment of FIG. 1A, it is assumed that the PC-TO-95 COMMAND 9 downloads a "1" value into location TRKLOC.

Other types of operating input parameters include parameters which dictate the points in the machine cycle at which various operations occur. In this regard, as prompted by display screen TIMEINFO the operator presses numeric keys on the keyboard 720 one or more PC-TO-95 COMMANDS 7 are generated and transmitted in the manner described above to DPS1 100'. Upon receipt of a PC-TO-95 COMMAND 7 the concurrent process PC_INT of DPS1 100' loads downloaded data values into memory locations. STRTIM (feeder start time i.e., the point in each machine cycle at which system stations are to feed documents),

DMPTIM (collector dump time i.e., the point in each machine cycle at which a collector associated with a system station is to dump documents into insert track 30), and OVRTIM (feeder override time (i.e., the point in a machine cycle at which an OVERRIDE condition is to be entered) at steps 884, 886, and 888, respectively.

Other types of operating input parameters are downloaded from the DPS2 700 to the DPS1 100' in a similar manner as that described above. In this respect, as prompted by screen display TWLS, a PC-TO-95 COMMAND 4 is transmitted by the DPS2 700 to download input values indicative of the maximum number of documents which can be fed (i.e. a preset piece count) for any group from certain stations. After waiting upon the signalling of semaphore PCINT and branching in accordance with the command number, the concurrent process PC_INT at step 874 moves the downloaded system piece count values and to corresponding locations in an array TWLVAL. Similarly, the display screen SYSMODE prompts the operator to designate whether the system feeder stations are in a reading or a non-reading mode, and whether a MATCHING mode is in effect. In the MATCHING mode a comparison is made either between (1) indicia on documents fed from different system stations; or (2) an actual count of the number of documents fed from a system station and an indication of the expected number of documents to be fed (the indication being provided elsewhere as in the control indicia, for example). Operator responses via keyboard 720 as prompted by display screen SYSMODE is used in the preparation of the PC-TO-95 COMMAND 5. When transmitted to the DPS1 100', the PC-TO-95 COMMAND 5 is used by concurrent process PC_INT to determine whether the flags SYSTEMP, SUBTEMP, and MATTMP should be set. In this respect, for a PC-TO-95 COMMAND 5 the concurrent process PC_INT at step 876 moves the downloaded data second byte into the location SYSTMP as an indication whether a system mode is pending. At step 878 the downloaded data third byte is moved into location SUBTMP as an indication whether a system submode is pending. At step 880 the downloaded data fourth byte is moved into location MATTMP as an indication whether a MATCH mode is pending.

Other types of downloaded operating parameters include various switch settings, such as a switch which determines how a DEMAND FEED mark is to be recognized. A DEMAND FEED can be initiated by either the presence or absence of a mark in a specified position in the control indicia. As described above, a DEMAND FEED condition essentially serves to stop the insert track 30 for a machine cycle so that a reading-type gripper station can feed a second document onto the insert track 30 for a group. The switch settings such as the DEMAND FEED switch are illustrated on a display screen SWITCHES. Operator input via keyboard 720 in response to display screen SWITCHES ultimately result in the generation of a PC-TO-95 COMMAND 12 which is transmitted to the DPS1 100'. Upon receipt of the PC-TO-95 COMMAND 12 the concurrent process PC_INT branches via decision 858 to step 900 whereat downloaded data bytes included in the PC-TO-95 COMMAND 12 are moved into corresponding locations in the array SWVAL.

As a sixth step in the start-up of the insertion machine system, and after the operational parameters are downloaded in the manner described above, the operator commences mechanical start up of the insertion ma-

chine by pressing an unillustrated START button on the machine control panel. Upon pressing of the start button the drive motor of the insertion machine is actively coupled to the rotating shafts discussed hereinbefore, including the incrementing rotational shafts which serve to advance the insert track indexing chain 30 and the envelope track indexing chain 48. Each rotation of the continuously rotating main timing shaft is referred to as a machine cycle.

During the first machine cycle, one or more documents included in a first group is deposited on the insert track 30 at a physical location thereof corresponding to the value stored in memory location TRKLOC. At the 280 degree point of the machine cycle, the semaphore SDEG(28) is signalled and the concurrent process PC_PERIOD, which was waiting on the signalling of semaphore SDEG(28) at step 910, resumes its execution. In connection with the generation of its 95-TO-PC COMMAND the concurrent process PC_PERIOD essentially functions to load into the output buffer SENDBF data including (1) portions of the SBUS record for the subgroup at the physical location on insert track 30 corresponding to the value of memory location TRKLOC; (2) the SBUS record for the group which is at the last physical position on track 30 (a position corresponding to the value in memory location LASTTRAK); and, (3) stations status flags from array STAST, feeder piece counts, and chargeback station flags.

FIG. 18 describes in more detail the steps associated with the execution of the concurrent process PC_PERIOD. At step 914 the contents of the location TRKLOC is used to determine which record in SBUS correspond to the first sought group on the insert track 30. In this respect, for the embodiment shown in FIG. 1A, the value in location TRKLOC is "1". Thus, for the particular embodiment shown in FIG. 1A, the location TRKLOC is indicative of the track position at which subgroups of documents are deposited on to the insert track by the control station 42.

Inasmuch as the concurrent process PC_PERIOD prepares a 95-TO-PC COMMAND in the output buffer SENDBF at step 912, the concurrent process PC_PERIOD must wait until the semaphore BUFAVL has been signalled before doing so. At step 914 the contents of the location TRKLOC is used to determine which record in SBUS corresponds to the first sought group on the insert track 30. In this respect, it will be recalled that the value in location TRKLOC is an integer constant representing the physical position along the insert track 30 at which a control document for a group is deposited on the insert track 30. In order to determine the record in SBUS which corresponds to the group at that physical location on the insert track, the pointer BINDEK is consulted. At step 916 the contents of location TRKLOC are loaded into the third byte of buffer SENDDF. At step 918 a portion of the first sought SBUS record (the SBUS record corresponding to the group just deposited by the control station on the insert track) is loaded in appropriate locations in buffer SENDBF. In particular, the portion of SBUS loaded into the buffer SENDBF includes bits 1 through 38 of the packed Boolean array portion of each record.

Having loaded a portion of the record in SBUS corresponding to the newest group of documents deposited on the insert track 30, the concurrent process PC_PERIOD then loads into the buffer SENDBF the

SBUS record corresponding to the oldest group of documents on the insert track 30. In connection with this load, the process PC_PERIOD uses the contents of location LASTTRAK to determine the oldest group on the track (steps 920, 922). At step 924 the station status flags from array STAST are packed and loaded into buffer SENDBF in a position corresponding to bytes 34-36 of the 95-TO-PC COMMAND 1. The station status flags from array STAST indicate whether a document was actually fed from each of the standard gripper stations and whether an envelope was actually fed from the envelope station. At step 926 the feeder piece counts from the array FDCNT are loaded into buffer SENDBF bytes 37 through 42. At step 928 the chargeback status flags from array CBCNTS are loaded into bytes 41 through 42 of the buffer SENDBF.

With the concurrent process PC_PERIOD having loaded appropriate data into the buffer SENDBF, the semaphore PCCMD(1) is signalled to indicate that a 95-TO-PC COMMAND 1 has been prepared (step 930). At step 932 the semaphore PCSEND is signalled to indicate that the 95-TO-PC COMMAND 1 is ready for transmission.

The signalling of the semaphore PCSEND causes the concurrent program IBM_PC to resume its execution (having awaited a signal at step 816). At step 818 the program IBM_PC, knowing that semaphore PCCMD(1) was the most recently signalled of the PCCMD semaphores, uses a directory look-up to determine the number of bytes associated with the most recently signalled PCCMD semaphore and puts that number of bytes into the second byte location in output buffer SENDBF. For a 95-TO-PC COMMAND 1, the number inserted into byte 2 is "44". At step 820 the concurrent program IBM_PC supervises the transmission of the 95-TO-PC COMMAND 1 to DPS2 700 using conventional handshaking techniques. Thereafter (step 822) the semaphore BUFAVL is signalled.

As mentioned above, when the insertion machine is operating normally, a 95-TO-PC COMMAND 1 is generated every machine cycle at the 280 degree point. The receipt of the 95-TO-PC COMMAND 1, as are all 95-TO-PC commands, is handled by the input driver 1002 and interpreted by the command Interpreter 1004.

As shown in FIG. 20, at step 1050 the command interpreter (CMDINTR) 1004 obtains the command number (from byte 1 of the 95-TO-PC COMMAND) Using a "SWITCH" instruction (represented by even numbered steps 1052 through 1080), the subroutine CMDINTR branches to appropriate instruction locations depending upon the command number. In the case of a 95-TO-PC COMMAND 1, the subroutine CMDINTR branches to step 1081. In connection with steps 1081 through 1112 it is seen in FIG. 20 that the subroutine CMDINTR basically (1) transfers data related to the group on the insert track at the location TRKLOC (generally the newest group on the track) into an array BUS_DATA_CMD1; (2) updates various counters used in the generation of statistical reports (i.e. used in the AUDIT TRAIL mode); and (3) transfers data relative to the group at the insert track location LASTRAK—the location on the insert track 30 at which the oldest group of documents resides—into an array LST_TRK_IMAGE. The array LST_TRK_IMAGE contains data for the last seven groups which have left the insert track 30 for further downstream processing.

Describing now at greater detail steps 1081 through 1112 of the subroutine CMDINTR, if this is the first 95-TO-PC COMMAND 1 the calendar start time from the clock 711 is consulted and stored at step 1081. At step 1082 the TRKLOC value from the 95-TO-PC COMMAND 1 is obtained and loaded into array BUS_DAT_CMD1. At step 1083 the remaining data items from the 95-TO-PC COMMAND 1 are obtained and loaded into appropriate locations in the array BUS_DATA_CMD1.

Having loaded the data from the 95-TO-PC COMMAND 1 into the array BUS_DATA_CMD1, the subroutine CMDINTR proceeds to update various counters which are used in the AUDIT TRAIL mode. In this regard, at step 1084 a check is made to determine whether the envelope status bit from the 95-TO-PC COMMAND 1 (i.e. command byte 34, bit 7) was set. If so, at step 1085 the counter AUD_CNT_ENV[0] is incremented.

At step 1086 the gripper status bits in bytes 34 through 36 of the 95-TO-PC COMMAND 1 are checked to determine whether each standard gripper station fed a document during the machine cycle. For the standard gripper stations which actually fed documents during associated this machine cycle, the counter AUD_CNT_STA[0][i] is updated. In this respect, it is understood that step 1086 and, if appropriate, step 1088 is executed for each gripper station i, where i ranges from 1 to NM GRIPPERS (the actual number of gripper stations employed in the given configuration).

In the same manner as described above for the gripper stations the system station piece count bytes (bytes 37 through 42 of the 95-TO-PC COMMAND 1) are checked to determine the number of documents fed from each system station during this machine cycle. In accordance with the status check, at step 1092 the counter AUD_CNT_FDR [0][i] is updated for each feeder station i, it being understood that the feeder station numbers i range from 1 to NM FEEDERS.

At step 1094 the chargeback status bits in bytes 43 and 44 of the 95-TO-PC COMMAND 1 are checked with respect to each standard gripper station to determine whether a chargeback occurred in connection with those stations during this machine cycle. At step 1096 the counter AUD_CNT_CHGBK[0][i] is updated in accordance with the status check.

At step 1098 the diverter status bits from the 95-TO-PC COMMAND 1 (bits 1 and 0 of byte 22 and bit 7 of byte 23) are checked to determine the status of the diverters, the status checks being made relative to the group on the insert track positioned at the "LAST-TRAK" position. In accordance with the status check, at step 1100 the counters AUD_CNT_DDTR[0][1] and AUD_CNT_DVTR[0][2] are updated.

In like manner as with the diverters, at step 1102 the postage meter status bits in the 95-TO-PC COMMAND 1 (bits 5, 4, and 3 of byte 24) are checked relative to the group of documents at the "LASTTRAK" position on the insert track 30. In accordance with the status check, at step 1104 the counters AUD_CNT_MTR[0][1] and AUD_CNT_MTR[0][2] are updated.

At step 1106 the value stored in bytes 32 and 33 the 95-TO-PC COMMANDS 1 are checked as an indication of the calculated weight of the stuffed envelope located at the "LASTTRAK" position on the insert track 30. These bytes correspond to the integer BWGHT stored in SBUS for the stuffed envelope at the "LASTTRAK" position. The integer BWGHT is a

representation of the projected weight of the stuffed envelope as calculated by the concurrent program CW, also known as computer weighing. Based on the calculated weight of the stuffed envelope at the "LAST-TRAK" position, at step 1108 an appropriate one of the weight category counters AUD_CNT_WTCTG[0][1] through AUD_CNT_WTCTG[0][5] is incremented. In this respect, counter AUD_CNT_WTCTG[0][1] is kept for the number of stuffed envelopes weighing 1 ounce or less, counter AUD_CNT_WTCTG[0][2] is kept for the number of stuffed envelopes weighing 2 ounces or less (but more than 1 ounce), and so forth.

Having updated the counter used in the AUDIT TRAIL mode, the subroutine CMDINTR updates the location OLD_PTR which points to the oldest column in the 7-column array LST_TRK_IMAGE. At step 1112 the information in bytes 19 through 33 of the 95-TO-PC COMMAND 1 pertaining to the group at the "LASTTRK" position on the insert track 30 are moved into the column of the array LST_TRK_IMAGE pointed by location OLD_PTR.

The just-described steps 1076 through 1112 of the subroutine CMDINTR are executed upon the receipt of each 95-PC-COMMAND 1. Thus, the AUDIT TRAIL counters mentioned during those steps are updated each machine cycle by the DPS2 700 in accordance with the results of the various status checks. In this respect, when it is noted that the checked conditions occur, the appropriate AUDIT TRAIL counters are incremented. Thus, the AUDIT TRAIL counter serve as continuously tallying work spaces for the current work shift.

As in the embodiment of FIG. 1, the insertion machine of the embodiment of FIG. 1A is capable of monitoring insertion machine operations over a plurality of time frames. In this respect, each of the files illustrated in FIG. 24 has memory locations that correspond to each of the actual AUDIT TRAIL counters listed in Chart 4. Thus, it is understood that AUDIT TRAIL counters are maintained over a plurality of time bases, with only the temporary counters associated with the current shift being incremented during normal operation of the insertion machine. Upon entry of the AUDIT TRAIL mode the contents of the temporary counters (i.e., the "[0]" dimensioned counters) for the current shift are copied into the permanent counters (i.e., the "[1]" dimensioned counters).

As described above, a 95-TO-PC COMMAND 1 is generated every machine cycle when the insertion machine is running. A 95-TO-PC COMMAND 11 can be generated as frequently as once every machine cycle. THE 95-TO-PC COMMAND 11 is used to transmit from the DPS1 100' to the DPS2 700 values indicative of the control switch status for the standard gripper stations as the status is reflected in array GSXCON. In this respect, after waiting $\frac{1}{4}$ second at step 944 the concurrent process PC_OPR checks at step 946 a flag GSXCHG to determine whether the contents of array GSXCON have been changed during the current machine cycle. If the contents of GSXCON have been changed, PC_OPR generates a new 95-TO-PC COMMAND 11 reflecting the change by (1) waiting for the buffer SENEb available (step 952); (2) clearing the flag GSXCHG (step 954); loading the buffer SENDBF with values indicative of the control switch status for the standard gripper stations (step 956); and, signalling the semaphores PCCMD(11) and PCSEND at steps 958 and 960, respectively. Clearing the flag GSXCHG at

step 954 prevents the generation of more than one 95-TO-PC COMMAND 11 per machine cycle.

As the insertion machine continues to run, the operator has the option of viewing on the monitor 718 certain ones of the display screens shown in FIG. 21. The display screens may be viewed in order to observe thereon certain values, including previously-downloaded operating input parameters and/or machine-related operating output data which has been transmitted from the DPS1 100' to the DPS2 700 in a 95-TO-PC COMMAND.

In the above regard, as the insertion machine continues to operate, the operator may wish to check the previously-downloaded per document weight value for a certain standard gripper station. To do so when viewing the display screen MAINMENU of FIG. 22A on the monitor 718, the operator presses the key "F4" on the keyboard 720, which results in the generation and display of screen display WEIGHMEN. Using a menu displayed on screen display WEIGHMEN, the operator presses a key which results in the generation of the screen display CHNGWGHT shown in FIG. 22C. Using the function keys "F5" and "F6" on the keyboard 720 the operator can scroll through the various feeder stations and envelope station included in the configuration of the insertion machine and obtain corresponding per document displays associated with these stations. In the particular display of CHNGWGHT shown in FIG. 22C, the downloaded per document weights for the control station 42, the sixth standard gripper station 57, and the envelope station 50 of the embodiment of FIG. 1A are being viewed. However, the operator cannot change the per document weight values while the insertion machine is running.

An example of the viewing of insertion machine-related operating output data is seen with reference to the display screen CNTDISPL of FIG. 22D. The screen display CNTDISPL allows the operator to observe the number of documents actually fed thus far from each standard gripper station and the envelope station 50, as well as the number of documents which have been assigned each weight category. As the operator selects the station for which the operator desires to observe the number of documents fed, the PC Manager 1006 supplies the screen generator 1016 with the current numerical count in the appropriate one of the audit counters. For example, if the operator wishes to observe the number of documents fed from the sixth gripper station (i.e. station 57) for the current shift, the PC Manager 1006 supplies the screen generator 1016 with the current value stored in the counter AUD_CNT_STA[0][6]. Likewise, should the operator wish to see the number of groups of documents thus far classified into weight category 2, the PC Manager 1006 supplies the screen generator 1016 with the current value of the audit counter AVD_CNTD WTCTG[0][2]. The operator is also able to see the current value of the audit counter AUD_CNT_ENV[0], which contains the number of envelopes actually fed during the current shift.

Another example wherein an operator can view insertion machine-related operating output data is provided with reference to display screen DEVINFO of FIG. 22E. The generation of display screen DEVINFO is prompted by the pressing of appropriate keys on keyboard 720 upon the viewing of the display screen MAINMENU and READMENU. Using either the function key "F1" or "F2" when viewing screen DE-

VINFOR the operator can select the device for which information (such as read indicia information) is to be displayed on the display screen DEVINFO.

In the above regard, it will be recalled that certain system stations can comprise a plurality of devices, and that each device for a given system station has associated therewith a device number. For example, the system control station 42 shown in the embodiment of FIG. 1A and illustrated in the display screen DEVINFO of FIG. 22E has a feeder device 42A and a collector device 42B. Thus, using the function keys "F1" and "F2", the operator can indicate whether it is desired to view information related to the indicia of the group currently in the collector 42B or of the group currently in the feeder 42A. Upon the pressing of either the "F1" or "F2" key on the keyboard 720 a new PC-TO-95 COMMAND 10 is generated. The PC-TO-95 COMMAND 10 is used to download to the DPS1 100' the station identification number and device identification number for the device for which the operator wishes to observe the indicia-related information on the documents currently being handled by that device. The PC Manager 1006 thus instructs the PC-TO-95 COMMAND formatter 1010 to prepare the PC-TO-95 COMMAND 10 which is transmitted via the output drive 1012 to the DPS1 100'.

Upon receiving the PC-TO-95 COMMAND 10 by the DPS1 100', the concurrent process PC_INT resumes its execution and branches to step 894 at which the third byte of the command is moved into memory location STAID. Likewise, at step 896 the fourth byte of the PC-TO-95 COMMAND 10 is moved into memory location DEVID. The two locations STAID and DEVID are periodically checked by numerous concurrent processes associated with the system stations included in a configuration. Each device comprising a system station has a corresponding data buffer in memory in which data including indicia-read data for the group currently being handled by the device is stored. As a group of document is transferred from one device to another, the information from the transferring device's buffer is copied into the transferred device's buffer. The concurrent process associated with each device monitors the contents of the locations STAID and DEVID and, when the contents of those locations match the station number and device number of a selected device, the concurrent process associated with the selected device copies its associated buffer into the buffer SENDBUF; signals the semaphore PCCMD(9); and, signals the semaphore PCSEND. Upon the signaling of semaphore PCSEND the concurrent program IBM_PC executes for the 95-TO-PC COMMAND and the steps 818 and 820 shown in FIG. 15, resulting in the transmission of the 95-TO-PC COMMAND 9 to the DPS2 700. In the illustrated embodiment a 95-TO-PC COMMAND 9 is generated for the collector of the control station 42 by a concurrent processes AIX-OPR.

Upon receipt of the 95-TO-PC COMMAND 9 by the input driver 1002 of the DPS2 700, the subroutine CMDINTR branches to step 1068 at which the contents of bytes 3 through 60 of the 95-TO-PC COMMAND 9 are loaded into memory locations DEV_INFO. The PC Manager 1006 makes the data and memory location DEV_INFO available to the screen generator 1016 and causes the screen generator 1016 to generate the display screen DEVINFO of FIG. 22E on the monitor 718. As seen in FIG. 22E, marks for the respective indicia fields

for the group at the device specified by the user are shown by a rectangular block associated with the described indicia field.

In the operation of an insertion machine a DEMAND FEED condition can occur. As mentioned before, the demand feed condition is entered when it is determined that a reading gripper station requires another machine cycle in order to feed therefrom a second document to be associated with a group currently before the reading gripper station on the insert track 30. In such a case the insert track 30 is decoupled from its intermittently rotating drive shaft for one machine cycle, thereby permitting the insert track 30 to remain essentially stationary for another machine cycle so that the reading station can feed another document onto the insert track 30 at the location where the group is situated. Upon the detection of a DEMAND FEED condition, as by an interrupt from a reading device, a 95-TO-PC COMMAND 7 is generated by the concurrent program associated with the reading gripper station with both semaphores PCCMD(7) and PCSEND being signalled. In the manner described above the concurrent program IBM_PC supervises the transmission of the 95-TO-PC COMMAND 7 to the DPS2 700.

Upon receipt of the 95-TO-PC COMMAND 7, the command interpreter 1004 of the DPS2 700 sets a flag DEMAND_FEED at step 1144. While the flag DEMAND_FEED is set a screen display OVRSTAT appears on the monitor 718. The next 95-TO-PC COMMAND 1 generated by the DPS1 100' concerns the machine cycle in which the DEMAND FEED condition is in effect. The 95-TO-PC COMMAND 1 generated during the DEMAND FEED mode is handled by the CMDINTR of DPS2 700 in the same manner as are all other 95-TO-PC COMMANDS 1, it being understood that, with the exception of data in the 95-TO-PC COMMAND 1 which relates to the reading gripper station, the data in the 95-TO-PC COMMAND 1 is essentially blank and has no effect upon the audit counters. The audit counter for the reading gripper station is, of course, incremented. When the DEMAND FEED condition is cleared, a 95-TO-PC COMMAND 8 is generated and transmitted by the concurrent program IBM_PC. Receipt of the 95-TO-PC COMMAND 8 results in the clearing of the flag DEMAND_FEED at step 1146 of the subroutine CMDINTR.

In the operation of an insertion machine an OVERRIDE condition can also occur. The OVERRIDE condition is entered when a device associated with a system station other than a reading gripper station determines that more than one machine cycle is required in order to completely feed all documents belonging to a subgroup onto the insert track 30. The concurrent process included in a concurrent program associated with the system station notes the existence of the OVERRIDE condition and prepares a 95-TO-PC COMMAND 5 upon entry of the OVERRIDE condition. Upon entry of the OVERRIDE condition the main timing shaft and intermittent shaft of the insertion machine become stopped at the point in the machine cycle indicated by the value of the downloaded input parameter OVRTIM, which is preferably at about 140 degrees of machine cycle. In the process of preparing the 95-TO-PC COMMAND 5 the concurrent process associated with the system station also signals the semaphores PCCMD(5) and PCSEND, thereby enabling the concurrent program IBM_PC to transmit the 95-TO-PC COMMAND 5 to the DPS2 700.

Upon receipt of the 95-TO-PC COMMAND 5 the CMDINTR 1004 of DPS2 700 sets a flag OVERRIDE (at step 1140) which is used by the PC Manager 1006 to direct the screen generator 1016 to generate a display screen OVRSTAT on the monitor 718. As long as the downloaded parameter OVRTIM indicates an OVERRIDE entry point in the machine cycle prior to 280 degrees, no 95-TO-PC COMMANDS 1 are generated during the OVERRIDE condition, and the audit counters are not affected (nor should they be since the value of FDCNT for the previous machine cycle included the number of documents fed during the OVERRIDE condition). While the flag OVERRIDE is set in the DPS2 700, the operator is precluded from downloading any machine operating input parameters, even though the insertion machine is technically stopped. Upon exit of OVERRIDE, the concurrent process (such as concurrent process AIX_OPR) associated with the affected system station generates a 95-TO-PC COMMAND 6 and signals the semaphores PCCMD(6) and PCSEND. Concurrent program IBM_PC transmits the 95-TO-PC COMMAND 6 to the DPS2 700, whereat CMDINTR 1004 clears the flag OVERRIDE (at step 1142) to rid monitor 718 of the display screen OVRSTAT.

When an ALERT AND CLEAR condition occurs documents belonging to a second batch are held up at a collector device or the like comprising the control station while the last groups included in the first batch are indexed down the insert track 30. An ALERT AND CLEAR condition is entered when a concurrent process associated with a device such as the collector 42B of the control station 42 detects the indication of the ALERT AND CLEAR condition (as by indicia on a control card) and prompts the generation of a 95-TO-PC COMMAND 10 by signalling the semaphore PCCMD(10) and the semaphore PCSEND. As described in connection with other commands the concurrent program IBM_PC supervises the transmission of the 95-TO-PC COMMAND 10 to the DPS2 700.

Upon receipt of the 95-TO-PC COMMAND 10 the DPS2 700 by its command interpreter 1004 sets a flag ALERT_CLEAR. The setting of the flag ALERT_CLEAR prompts the generation of a screen display ACFEEDSP. During the ALERT AND CLEAR condition, subsequent 95-TO-PC COMMANDS 1 generated during the ALERT AND CLEAR have essentially empty data fields and have no effect upon the audit counters of DPS2 700. The flag ALERT_CLEAR is set until the operator hits a designated key on the keyboard 720 in response to the prompt of screen ACFEEDSP to clear the ALERT AND CLEAR condition. Upon pressing of the appropriate key on the keyboard 720 to clear the ALERT AND CLEAR condition, the PC Manager 1006 instructs the PC-TO-95 command formatter 1010 to generate a PC-TO-95 COMMAND 11, which informs the DPS1 100' that the ALERT AND CLEAR condition has been removed. In addition, pressing of the appropriate key as prompted by the screen display ACFEEDSP clears the flag ALERT_CLEAR so that the subsequent 95-TO-PC COMMAND 1 is not ignored.

If a procedure or concurrent process associated with a system station detects the occurrence of a "fault" at the system station, the insertion machine enters a FAULT mode. The detected faults can be of various types, the fault types being understood with reference to the 95-TO-PC COMMAND 3 of Chart 1. For exam-

ple, if the concurrent process associated with a system station determines that the system station is expected to feed a number of documents which exceeds a preset maximum limit (the present maximum limit having been downloaded by a PC-TO-95 COMMAND 4 into array TWLVAL), a fault of type 7 (known as a high count fault) occurs.

Upon the detection of a fault such as a type 7 (high count) fault when buffer SENDBF is available the associated procedure or concurrent process prepares a 95-TO-PC COMMAND 3 by (1) filling buffer SENDBF with data (as described with reference to the 95-TO-PC COMMAND 3 format of Chart 1); (2) signalling semaphore PCCMD(3); and (3) signalling semaphore PCSEND. For a fault type 7 occurring in the configuration of embodiment FIG 1A, for example, concurrent process AIX OPR associated with control station 42 instructs procedure AIX_PCF to generate a 95-TO-PC COMMAND 3. In preparing the command, procedure AIX_PCF inter alia puts a "7" in the third byte of the command as an indication of the fault type; puts the ID number of station 42 in the fourth byte of the command to indicate the station whereat the fault occurred; puts a number in the fifth byte of the command to indicate at what device (either the collector device 42B or the feeder device 42A) the fault occurred; puts an indication in the seventh byte of the command whether the DPS1 100' must generate a 95-TO-PC COMMAND 4 (to acknowledge recovery of the fault); and, puts the prohibited number of documents which the station would have then attempted to feed into the eighth and ninth bytes of the command. As described hereinbefore in connection with other commands, the signalling of semaphore PCSEND ultimately results in the transmission of the 95-TO-PC COMMAND 3 by the concurrent program IBM PC to the DPS2 700.

Upon receipt of the 95-TO-PC COMMAND 3 by the DPS2 700, the CMDINTR 1004 branches to step 1122 of FIG. 20 whereat flag FAULT_FLG is set. At step 1124 the data included in the 95-TO-PC COMMAND 3 is loaded into an array FLT ARY. The PC Manager 1006 uses the data in the array FLT ARY including data indicative of the fault type to direct the screen generator 1016 to generate an appropriate display on monitor 718. For example, for the fault type 7 the display screen HCS as shown in FIG. 22G occurs on monitor 718. The names of other display screens displayable on monitor 718 as a result of the occurrence of fault types (understood with reference to the 95-TO-PC COMMAND 3 format of Chart 1) are shown in FIG. 21.

For some fault types the operator need merely press a key on keyboard 718 to confirm that the operator has taken whatever action is necessary in order to remedy the fault. For some fault types sensors associated with the system station must sense an indication of the remedial action. In the latter case, upon receiving an indication of the remedial action a procedure or concurrent process associated with the system station generates a 95-TO-PC COMMAND 4 and signals the semaphores PCCMD(4) and PCSEND. In like manner as described before in connection with other commands, the 95-TO-PC COMMAND 4 is transmitted by concurrent program IBM_PC to the DPS2 700.

Upon receipt of the 95-TO-PC COMMAND 4, the CMDINTR 1004 of DPS2 700 performs steps 1130 and 1132 of FIG. 20 which make it possible for the operator to press a key on keyboard 720 to confirm that the operator has taken the necessary action to remedy the

fault. Once the key is pressed, the DPS2 700 generates a PC-TO-95 COMMAND 2 to notify the DPS1 100' that all fault errors have been cleared.

As the insertion machine runs, the signal on line 136 in the machine cycle detection circuit 114 (see FIG. 3) is continually monitored by the concurrent program MMONITOR. As long as the main timing shaft is rotating, the program MMONITOR keeps a flag RUNNIN in a set condition. If the main timing shaft stops rotating, the flag RUNNIN is cleared. As is shown in FIG. 17, every $\frac{1}{2}$ second the concurrent process PC_OPR checks the status of flag RUNNIN (step 948). As long as the flag RUNNIN remains set, a flag RUN_LAST_TIME remains set.

Should the insertion machine timing shaft stop rotating (as occurs during a fault, for example), and the flag RUNNIN accordingly be cleared, process PC OPR branches to step 950. Upon the first execution of step 950 the flag RUN_LAST_TIME will still be set, indicating that a 95-TO-PC COMMAND 2 must be generated. To generate a 95-TO-PC COMMAND 2, flag RUN_LAST_TIME is cleared and, when the buffer SENDBF is available, the semaphores PCCMD(2) and PCSEND are signalled in sequence. In the manner described before in conjunction with other commands, the program IBM_PC then transmits the 95-TO-PC COMMAND 2 to the DPS2 700.

Upon receipt of the 95-TO-PC COMMAND 2, the CMDINTR 1004 of DPS2 700 branches to step 1120 of FIG. 20 whereat flag STOPPED is set. When the PC Manager 1006 notes that the flag STOPPED has been set, the PC Manager (1) determines the actual run time elapsed since the most recent machine start; (2) adds the elapsed actual run time to the FRAME1 running time audit timer; and (3) stores the calendar clock time of the stop for future access and comparison.

After preparing its 95-TO-PC COMMAND 2, the concurrent process PC_OPR loops back to step 944. After a $\frac{1}{2}$ second delay, if the flag RUNNIN is still cleared (i.e., the machine timing shaft is still stopped), the status of flag RUN_LAST_TIME is checked at step 950. With the flag RUN_LAST_TIME having been cleared at step 964 during the preceding loop of PC OPR, process PC_OPR realizes that a 95-TO-PC COMMAND 2 has already been prepared and that a 95-TO-PC COMMAND 14 should be generated. As is understood with reference to Chart 1, the 95-TO-PC COMMAND 14 partially resembles the data included in a 95-TO-PC COMMAND 1 in that a portion of the SBUS record for the group located at position "TRKLOC" is included in the command. To prepare the 95-TO-PC COMMAND 14, PC OPR executes the following steps: (1) awaits availability of buffer SENDBF (step 972); (2) uses the contents of location TRKLOC to determine what record in SBUS is to be utilized (step 974); (3) moves a portion of the designated record of SBUS into the buffer SENDBF (step 976); and (4) signals the semaphores PCCMD(14) and PCSEND. In the manner described hereinbefore with reference to other commands, program IBM PC transmits the 95-TO-PC COMMAND 14 to the DPS2 700.

Upon receipt of the 95-TO-PC COMMAND 14, the CMDINTR 1004 of DPS2 700 branches to steps 1162 and 1164 whereat appropriate flags are set and whereat the bus image data from the command is loaded into an array BUS_DATA_CMD14. At the direction of the PC Manager 1006 the screen generator 1016 can, when

requested, use the data in array `BUS_DATA_CMD14` to generate the display screen `TRACKINFO`.

When the insertion machine is again started after being stopped, the `DPS2 700` knows of the start by virtue of the receipt of a new `95-TO-PC COMMAND`. 1. When the `DPS2 700` realizes that the insertion machine has again been started, the `PC Manager 1006` executes the following steps: (1) obtains the "start" calendar time from clock `711`; (2) subtracts the last previously-referenced calendar time from the first-obtained start calendar time; (3) adds the subtraction result of (2) to the fault time audit timer; and (4) stores the just-obtained start calendar time as the last referenced calendar time.

`FIG. 22F` shows the screen display `AUDIT` which is selectively displayable on the monitor `718`. As prompted by the display `AUDIT`, the operator can provide input via keyboard `720` to direct the `PC Manager 1006` to enter the `AUDIT TRAIL` mode. As seen hereinafter, the operator can provide input on keyboard `720` as to result in the generation of a printed report or to accumulate values in the various audit counters. When a function key other than "F10" is pressed on keyboard `720`, program `PC Manager 1006` calls subroutine `1014 (AUDIT TRAIL PROCESSING)` and provides to subroutine `AUDIT TRAIL PROCESSING` an indication as to whether a printout or accumulation is required, and for what time frame the printout or accumulation is required.

`FIG. 23` shows steps executed by the subroutine `AUDIT TRAIL PROCESSING`. At step `1200` the subroutine requests the `PC Manager 1006` to direct the `Command Formatter 1010` and the `Output Driver 1012` to prepare and transmit a `PC-TO-95 COMMAND 8` to the `DPS1 100`. Upon receipt of the `PC-TO-95 COMMAND 8`, the concurrent process `PC_INT` clears flag `ERRCLR`, which causes a hard fault of the insertion machine (stopping the rotating main timing shaft). In this respect, the insertion machine must be stopped while `AUDIT TRAIL` processes are performed lest continuing machine operations go uncounted.

After effectively hard faulting the insertion machine, the subroutine `AUDIT TRAIL PROCESSING` (1) determines the actual run time elapsed since the most recent machine start (step `1202`); (2) adds the elapsed actual run time to the running time audit time (Step `1204`); and (3) stores the calendar clock time of the stop for future access and comparison (step `1206`).

At step `1208` the subroutine `AUDIT TRAIL PROCESSING` copies the contents of the temporary `AUDIT TRAIL` counters into the actual counters. For example, the contents of `AUD_CNT_ENV[0]` is copied into counter `AUD_CNT_ENV[1]`. Similar copies are made with respect to each of the audit counters listed in `Chart 4`.

At step `1210` a determination is made whether an accumulate function or printout function has been requested with respect to the `AUDIT TRAIL` mode. If an accumulate function has been requested a logical determination is made (steps `1220`, `1222`, `1224`, `1226`, and `1228`) regarding the type of `AUDIT TRAIL` file (i.e., shift file, week file, month file, quarter file, or year file) for which the accumulation is to occur.

If it is determined at step `1220` that the accumulation is for a shift file, pointer `SHIFT_FILE POINTER` is incremented (at step `1230`) and the contents of the actual audit counters are loaded into corresponding locations in the shift file pointed to by the contents of `SHIF-`

`T_FILE_POINTER` (step `1232`). If, on the other hand, it is determined at step `1222` that the accumulation is for a week file, the pointer `WEEK_FILE POINTER` is incremented at step `1234`. Then, at step `1236`, the contents of like `AUDIT TRAIL` counters stored on the shift files are summed. As an example, values representing the number of envelopes fed for each shift are summed for each shift beginning with `SHIFT1` and ending with `SHIFTX` (where `X`=the contents of `SHIFT_FILE POINTER`). Thereafter, at step `1238`, the summation from step `1236` is stored in the week file pointed to by `WEEK_FILE_POINTER`. From `FIG. 23` it is seen that comparable steps are executed with respect to a month accumulate request (steps `1240`, `1242`, and `1244`); a quarter accumulate request (steps `1246`, `1248`, and `1250`); and, a year accumulate request (steps `1252` and `1254`). During the accumulate request the `PC Manager 1006` supervises the interaction of the `AUDIT TRAIL PROCESSING` subroutine `1014` and the hard disc handler `1018`.

If an `AUDIT TRAIL` printout is requested as determined at step `1210`, the `PC Manager 1006` supervises the generation by the printer handler `1022` of a statistical report. In this respect the numerical contents of the audit trail counters of `Chart 4` are printed in association with appropriate printed label text. The computation and printing of the number of envelopes per hour, the number of envelopes per actual running hour and the average machine cycle speed essentially resemble even numbered steps `562` through `572` of `FIG. 10`.

In generating its statistical report the subroutine `AUDIT TRAIL PROCESSING` determines at steps `1260`, `1262`, `1264`, `1266`, and `1268`, whether the requested report is for a shift, week, month, quarter, or year, respectively. If the requested report is for a shift, at step `1270` the `PC Manager 1006` is requested to direct the printer handler `1022` to print the shift file pointed to by the location `SHIFT_FILE_POINTER`. If the requested report is for a week, at step `1272` the `PC Manager 1006` is requested to direct the printer handler `1022` to print all the shift files (as separate reports) and the week file pointed to by location `WEEK_FILE_POINTER`. Similar steps are executed upon a month report request (step `1274`); a quarter report request (step `1276`); and a year report request (step `1278`).

While the invention has been particularly shown and described with reference to the preferred embodiments thereof, it will be understood by those skilled in the art that various alterations in form and detail may be made therein without departing from the spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of monitoring a plurality of operations performed by a machine of the type in which a plurality of feed stations selectively feed documents onto an insert track for inclusion with a group of related documents, said method comprising the steps of:

- establishing an initiation time for a first time base during which said plurality of operations are to be monitored;
- counting, over said first time base, the number of events associated with each of said plurality of operations;
- establishing at least a temporary termination time for said first time base at which said count is at least temporarily terminated; and,

averaging the number of events counted over said first time base to obtain an indication with respect to one of said operations of the number of events occurring per unit of time.

2. A method of monitoring a plurality of operations 5 performed by a machine of the type in which a plurality of feed stations selectively feed documents onto an insert track for inclusion with a group of related documents, said method comprising the steps of:

- establishing an initiation time for a first time base 10 during which said plurality of operations are to be monitored;
- counting, over said first time base, the number of events associated with each of said plurality of operations; 15
- establishing at least a temporary termination time for said first time base at which said count is at least temporarily terminated; and,
- providing an indication of the number of events 20 counted over said first time base with respect to each of said plurality of operations, and wherein said plurality of operations includes a stoppage of said machine.

3. A method of operating a machine of the type 25 wherein, in accordance with a machine cycle, a plurality of feed stations selectively feed documents onto an insert track for inclusion with a group of documents, said method comprising the steps of:

- (a) determining the number of documents fed from 30 one of said feed stations;
- (b) determining a machine cycle speed at which said machine is operating;
- (c) providing an indication of the determinations made in steps (a) and (b); and,
- (d) using said indications in order to adjust said machine cycle speed to a preferred speed. 35

4. A method of operating a document handling machine of the type in which a plurality of types of processing stations perform processing events in coordinated manner to associate related documents in a group 40 and to at least partially prepare said group of documents for shipment, said plurality of types of processing stations comprising (1) insert processing stations which perform the processing event of feeding documents onto an insert track for inclusion with appropriate groups of documents; and (2) a packaging station which performs the processing event of enveloping a group of documents on said insert track into a packaging medium; 45

said machine further being of the type in which first data processing means manages the operation of said processing stations, said first data processing means comprising (1) first processor means for executing coded instructions including coded instruction suitable for use in controlling the operation of said processing stations; (2) first memory means for storing data and coded instructions; and, 50

- (3) first I/O means for facilitating input and output operations with respect to said first data processing means, said method comprising the steps of: 60

- providing a data bus in said first memory means, said data bus comprising a number N of data records related to a number of groups of documents movable on said insert track, each data record comprising 65

- record elements for storing informational data relative to processing events performable by various ones of said processing stations with respect to

the group of documents associated with its data record,

- configuring said instructions executed by said first data processing means to load machine-related output data into an output buffer included in said first memory means;
- loading into said output buffer at a predetermined point in a given machine cycle at least a portion of the informational data included in a record in said data bus then associated with a predetermined physical position on said insert track;
- loading into said output buffer at said predetermined point in said given machine cycle information indicative of whether certain processing stations performed their respective processing event during the given machine cycle;
- providing a second data processing means for processing said machine-related output data loaded into said output buffer of said first data processing means, said second data processing means comprising second processor means for executing coded instructions, second memory means for storing data and coded instructions including coded instructions suitable for processing said machine-related output data loaded into said output buffer of said first data processing means, and second I/O means for facilitating input and output operations with respect to said second data processing means;
- using data transmission means to connect said first I/O means and said second I/O means in a manner whereby said machine-related output data in said output buffer of said first data processing means is transmittable to said second data processing means; and,
- using said second data processing means to perform arithmetic operations with respect to portions of the machine-related output data loaded into said output buffer and transmitted to said second data processing means over said data transmissions means, said portions of said machine-related output data including (1) informational data included in said record in said data bus then associated with said predetermined physical position on said insert track, and (2) said information indicative of whether certain processing stations performed their respective processing events during said given machine cycle.

5. The method of claim 4, wherein said arithmetic operations performed by said second data processing means include the counting over a first time frame of the number of indications received by said second data processing means of the number of processing events performed by said certain processing stations.

6. The method of claim 4, wherein said predetermined physical positions on said insert track is a downstream-most position.

7. The method of claim 6, further comprising the steps of:

- providing locations in said second memory means for storing at least a portion of the informational data in said output buffer transmitted to said second data processing means for a plurality M of transmissions;
- loading at least a portion of the informational data in said output buffer transmitted to said processing means into one of said locations; and,
- maintaining said portion of said informational data in said output buffer for a predetermined number of

57

machine cycles after the group associated with said record from whence said informational data was obtained has left the insert track.

8. The method of claim 7, further comprising the step of providing an indication on indicator means connected to said second data processing means of the contents of said locations whereat said informational data is maintained after the group associated with said record from whence said informational data was obtained has left the insert track.

9. A document handling machine comprising:

insert track means for transporting documents in timed relation to a machine cycle;

a plurality of types of processing stations which perform processing events in coordinated manner to associate related documents in a group and to at least partially prepare said group of documents for shipment, said plurality of types of processing stations comprising:

insert processing stations which perform the processing event of feeding documents onto said insert track means for inclusion with appropriate groups of documents; and,

a packaging station which performs the processing event of enveloping a group of documents on said insert track means into a packaging medium;

first data processing means for managing the operation of said processing stations, said first data processing means comprising first processor means for executing coded instructions including coded instruction suitable for use in controlling the operation of said processing stations, first memory means for storing data and coded instructions, and first I/O means for facilitating input and output operations with respect to said first data processing means, said first data processing means being configured to manage the operation of said processing stations by executing said coded instructions and to load machine-related output data into an output buffer included in said first memory means;

second data processing means for processing said machine-related output data loaded into said output buffer of said first data processing means, said second data processing means comprising second processor means for executing coded instructions, second memory means for storing data and coded instructions including coded instructions suitable for processing said machine-related output data loaded into said output buffer of said first data processing means, and second I/O means for facilitating input and output operations with respect to said second data processing means;

data transmission means for connecting said first I/O means and said second I/O means and whereby said machine-related output data in said output buffer of said first data processing means is transmitted to said second data processing means; and, indicator means connected to said second data processing means for providing an indication of said machine-related output data.

10. The machine of claim 9, further comprising: machine cycle detector connected to said first I/O means of said first data processing means and means positioned with respect to said document handling machine for detecting the reaching of certain points in said machine cycle, said certain points in said machine cycle being related to the desired timing of the processing events perform-

58

able by various ones of said processing stations, and wherein said machine-related output data is loaded into said output buffer at a predetermined point in said machine cycle.

11. The machine of claim 10, further comprising:

a data bus included in said first memory means, said data bus comprising a number N of data records related to a number of groups of documents movable on said insert track, each data record comprising record elements for storing informational data relative to processing events performable by various ones of said processing stations with respect to the group of documents associated with its data record, and wherein at said predetermined point in said machine cycle at least a portion of the informational data included in a record in said data bus then associated with a first predetermined physical position on said insert track is loaded into said output buffer.

12. The machine of claim 11, wherein at said predetermined point in said machine cycle informational data included in a record in said data bus then associated with a second pre-determined physical position on said insert track is also loaded into said output buffer.

13. The machine of claim 9, further comprising a fault detector connected to said first I/O means of said first data processing means and positioned with respect to an associated processing station included in said document handling machine for detecting the occurrence of a faulty processing event at said associated processing station, and wherein machine-related output data indicative of said faulty processing event is loaded into said output buffer upon the detection by said fault detector of said faulty occurrence.

14. The machine of claim 13, further comprising a plurality of fault detectors connected to said first I/O means of said first data processing means, said plurality of fault detectors being positioned with respect to a plurality of types of correspondingly associated processing stations included in said document handling machine for detecting the occurrence of a plurality of types of faulty processing events, and wherein said machine-related output data indicative of a faulty processing event which occurred at a faulty processing station is loaded into said output buffer upon the detection of said faulty occurrence by said fault detector associated with said faulty station.

15. The machine of claim 26, wherein said machine-related output data loaded into said output buffer includes an indication of the type of fault detected and the processing station at which the fault was detected.

16. The machine of claim 21, wherein said machine-related output data is loaded into said output buffer included in said first memory means in response to a machine-related input command generated by said second data processing means and transmitted to said first data processing means over said data transmission means.

17. The machine of claim 16, further comprising data entry means connected to said second data processing means for enabling said second data processing means to generate said machine-related input command.

18. The machine of claim 9, wherein said second data processing means performs an arithmetic operation with respect to at least a portion of the machine-related output data loaded into said output buffer and transmitted to said second data processing means over said data transmission means.

19. The machine of claim 18, wherein said machine-related output data loaded into said output buffer includes an indication to which one of a plurality of postage classifications a group of documents belongs, and wherein said arithmetic operation performed by said second data processing means includes the counting of the number of groups of documents belonging to each postage classification.

20. The machine of claim 18 further comprising:
 means for detecting a specified condition associated with a group of documents;
 means for diverting from said insert track said group of documents in connection with which said specified condition was detected;
 wherein said machine-related output data loaded into said output buffer includes an indication of the detection of said specified condition; and,
 wherein said arithmetic operation performed by said second processing means includes the counting of the number of groups of documents for which said specified condition is detected.

21. The machine of claim 18, wherein said machine-related output data loaded into said output buffer includes an indication of whether a processing event was performed by a given processing station for a group of documents, and wherein said arithmetic operation performed by said second data processing means includes the counting of the number of groups of documents for which the given processing station has performed its processing event.

22. The machine of claim 18, further comprising a storage medium connected to said second data processing means to which is written information indicative of the result of said arithmetic operation performed by said second data processing means.

23. The machine of claim 22, wherein said information indicative of the result of said arithmetic operation is periodically written to a non-volatile storage medium.

24. The machine of claim 18, further comprising data entry means connected to said second data processing means for entering a directive to said second data processing means, wherein in response to a particular directive said second data processing means causes information indicative of said arithmetic operation performed by said second data processing means to be written to said storage medium, and wherein said second data processing means generates a stop command which is transmitted to said first data processing means by said data transmission means whereby processing events cannot be performed at least while said information indicative of said arithmetic operation is being written to said storage medium.

25. A document handling machine comprising:

insert track means for moving groups of documents in timed relation to a machine cycle;

a plurality of types of processing stations which perform processing events in coordinated manner to associated related documents in a group and to at least partially prepare said group of documents for shipment, said plurality of types of processing stations comprising:

insert processing stations which perform the processing event of feeding documents onto said insert track means for inclusion with appropriate groups of documents; and,

a packaging station which performs the processing event of enveloping a group of documents on said insert track means into a packaging medium;

first data processing means for managing the operation of said processing stations of said document handling machine, said first data processing means comprising first processor means for executing coded instructions including coded instructions suitable for use in controlling the operation of said processing stations, first memory means for storing coded instructions and data including downloaded input parameters, and first I/O means for facilitating input and output operations with respect to said first data processing means, said data processing means being configured to manage the operation of said processing stations by executing said coded instructions;

second data processing means for downloading said machine-related input parameters to said first data processing system, said second data processing means comprising second processor means for executing coded instructions, second memory means for storing data and coded instructions, and second I/O means for facilitating input and output operations with respect to said second data processing means; and,

data transmission means connecting said first I/O means and said second I/O means whereby said machine-related input parameters are transmitted from said second data processing means to said first data processing means;

data entry means connected to said second data processing means for entering said machine-related input parameters into said second memory means.

26. The machine of claim 25, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter that influences the selective feeding of documents from one of said insert processing stations.

27. The machine of claim 26, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter that specifies that an insert processing station which performs the processing event of feeding documents into said insert track means is to selectively feed a document therefrom for inclusion with a related group of documents in accordance with sensed indicia provided on a control document belonging to said group.

28. The machine of claim 26, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter that specifies that an insert processing station which performs the processing event of feeding documents onto said insert track may feed a document therefrom for inclusion with a related group of documents if the feeding of said document will not increase the weight of said group of documents sufficiently to change the postal weight classification of said group of documents.

29. The machine of claim 25, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter which is indicative of the per document weight of documents stored at one of said insert processing stations, and wherein said per document weight parameter is stored in said first memory means and utilized by said first data processing means in the calculation of a projected weight of a group of documents.

30. The machine of claim 25, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter which is indicative of a maximum number of documents which one of said insert processing stations is permitted to feed with respect to any one group of documents.

31. The machine of claim 25, wherein one of said insert processing stations which performs the processing event of feeding documents onto said insert track means has sensing means associated therewith for sensing information relative to at least one document fed therefrom, and wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter indicative of whether said sensing means is to be utilized to sense said information.

32. The machine of claim 31, wherein said first data processing means is configured to determine whether information sensed by said sensing means with respect to a document fed for inclusion with a particular group corresponds to information provided on a control document also belonging to said group.

33. The machine of claim 25, further comprising detector means positioned with respect to said insertion machine for detecting the reaching of certain points in said machine cycle, said certain points in said machine cycle being related to the desired timing of the processing events performable by various ones of said processing stations; and wherein said machine related input parameters downloaded from said second data processing means to said first data processing means includes a parameter indicative of a point in said machine cycle at which it is desired for a processing station to perform its processing event.

34. The machine of claim 25, further comprising output means connected to said second data processing means, and wherein coded instructions executed by said second data processing means cause the generation of a request via said output means for the entry of information indicative of a machine-related input parameter through said data entry means.

35. A method of operating a document handling machine of the type in which a plurality of types of processing stations perform processing events in coordinated manner to associate related documents in a group and to at least partially prepare said group of documents for shipment, said plurality of types of processing stations comprising (1) insert processing stations which perform the processing event of feeding documents onto an insert track for inclusion with appropriate groups of documents; and (2) a packaging station which performs the processing event of enveloping a group of document on said insert track in a packaging medium;

said machine further being of the type in which first data processing means manages the operation of said processing stations, said first data processing means comprising (1) first processor means for executing coded instructions including coded instruction suitable for use in controlling the operation of said processing stations; (2) first memory means for storing data and coded instructions; and (3) first I/O means for facilitating input and output operations with respect to said first data processing means, said method comprising the steps of: configuring said instructions executed by said first data processing means to load machine-related

output data into an output buffer included in said first memory means;

providing a second data processing means for processing said machine-related output data loaded into said output buffer of said first data processing means, said second data processing means comprising second processor means for executing coded instructions, second memory means for storing data and coded instruction including coded instructions suitable for processing said machine-related output data loaded into said output buffer of said first data processing means, and second I/O means for facilitating input and output operations with respect to said second data processing means;

using data transmission means to connect said first I/O means and said second I/O means in a manner whereby said machine-related output data in said output buffer of said first data processing means is transmittable to said second data processing means; and,

providing an indication of said machine-related output data on indicator means connected to said second data processing means.

36. The method of claim 9, further comprising the steps of:

connecting a machine cycle detector to said first I/O means of said first data processing means for detecting the reaching of certain points in a machine cycle, said certain points in said machine cycle being related to the desired timing of the processing events performable by various ones of said processing stations; and,

loading said machine-related output data into said output buffer at a predetermined point in said machine cycle.

37. The method of claim 36, wherein a data bus is included in said first memory means, said data bus comprising a number N of data records related to a number of groups of documents movable on said insert track, each data record comprising record elements for storing informational data relative to processing events performable by various ones of said processing stations with respect to the group of documents associated with its data record, and wherein said method further comprises the step of:

loading into said output buffer at said predetermined point in said machine cycle at least a portion of the informational data included in a record in said data bus then associated with a first predetermined physical position on said insert track.

38. The method of claim 37, further comprising the step of: enveloping a group of documents on said insert track into a packaging medium;

said machine further being of the type in which first data processing means manages the operation of said processing stations, said first data processing means comprising (1) first processor means for executing coded instructions including coded instruction suitable for use in controlling the operation of said processing stations; (2) first memory means for storing data and coded instructions; and, (3) first I/O means for facilitating input and output operations with respect to said first data processing means, said method comprising the steps of:

configuring said instructions executed by said first data processing means to load machine-related output data into an output buffer included in said first memory means;

providing a second data processing means for processing said machine-related output data loaded into said output buffer of said first data processing means, said second data processing means comprising second processor means for executing coded instructions, second memory means for storing data and coded instructions including coded instructions suitable for processing said machine-related output data loaded into said output buffer of said first data processing means, and second I/O means for facilitating input and output operations with respect to said second data processing means; using data transmission means to connect said first I/O means and said second I/O means in a manner whereby said machine-related output data in said output buffer of said first data processing means is transmittable to said second data processing means; and,

also loading into said output buffer at said predetermined point in said machine cycle the informational data included in a record in said data bus then associated with a second pre-determined physical position on said insert track.

39. The method of claim 35, further comprising the steps of:

- connecting a fault detector to said first I/O means of said first data processing means and positioning said fault detector with respect to an associated processing station included in said document handling machine for detecting the occurrence of a faulty processing event at said associated processing station; and,
- loading machine-related output data indicative of said faulty processing event into said output buffer upon the detection by said fault detector of said faulty occurrence.

40. The method of claim 39, further comprising the steps of:

- connecting a plurality of fault detectors to said first I/O means of said first data processing means, said plurality of fault detectors being positioned with respect to a plurality of types of correspondingly associated processing stations included in said document handling machine for detecting the occurrence of a plurality of types of faulty processing events; and,
- loading said machine-related output data indicative of a faulty processing event which occurred at a faulty processing station into said output buffer upon the detection of said faulty occurrence by said fault detector associated with said faulty station.

41. The method of claim 40, wherein said machine-related output data loaded into said output buffer includes an indication of the type of fault detected and the processing station at which the fault was detected.

42. The method of claim 35, wherein said machine-related output data is loaded into said output buffer included in said first memory means in response to a machine-related input command generated by said second data processing means and transmitted to said first data processing means over said data transmission means.

43. The method of claim 42, further comprising the step of:

- connecting data entry means to said second data processing means for enabling said second data processing means to generate said machine-related input command.

cessing means to generate said machine-related input command.

44. The method of claim 35, further comprising the step of:

- using said second data processing means to perform an arithmetic operation with respect to at least a portion of the machine-related output data loaded into said output buffer and transmitted to said second data processing means over said data transmission means.

45. The method of claim 44, wherein said machine-related output data loaded into said output buffer includes an indication to which one of a plurality of postage classifications a group of documents belongs, and wherein said arithmetic operation performed by said second data processing means includes the counting of the number of groups of documents belonging to each postage classification.

46. The method of claim 44 further comprising:

- detecting a specified condition associated with a group of documents;
- diverting from said insert track said group of documents in connection with which said specified condition was detected;
- including in said machine-related output data loaded into said output buffer an indication of the detection of said specified condition; and,
- including in said arithmetic operation performed by said processing means the counting of the number of groups of documents for which said specified condition is detected.

47. The method of claim 44, wherein said machine-related output data loaded into said output buffer includes an indication of whether a processing event was performed by a given processing station for a group of documents, and wherein said arithmetic operation performed by said second data processing means includes the counting of the number of groups of documents for which the given processing station has performed its processing event.

48. The method of claim 44, further comprising the step of connecting a storage medium to said second data processing means to which is written information indicative of the result of said arithmetic operation performed by said second data processing means.

49. The method of claim 48, wherein said information indicative of the result of said arithmetic operation is periodically written to a non-volatile storage medium.

50. The method of claim 44, further comprising the steps of:

- connecting data entry means to said second data processing means for entering a directive to said second data processing means, wherein in response to a particular directive said second data processing means causes information indicative of said arithmetic operation performed by said second data processing means to be written to said storage medium; and,
- using said second data processing means to generate a stop command which is transmitted to said first data processing means by said data transmission means whereby processing events cannot be performed at least while said information indicative of said arithmetic operation is being written to said storage medium.

51. A method of operating a document handling machine of the type in which a plurality of types of processing stations perform processing events in coordi-

nated manner to associate related documents in a group and to at least partially prepare said group of documents for shipment, said plurality of types of processing stations comprising (1) insert processing stations which perform the processing event of feeding documents onto an insert track for inclusion with appropriate groups of documents; and (2) a packaging station which performs the processing event of enveloping a group of documents on said insert track into a packaging medium;

said machine further being of the type in which first data processing means manages the operation of said processing stations, said first data processing means comprising (1) first processor means for executing coded instructions including coded instruction suitable for use in controlling the operation of said processing stations; (2) first memory means for storing data and coded instructions; and, (3) first I/O means for facilitating input and output operations with respect to said first data processing means, said method comprising the steps of:

providing second data processing means for downloading machine-related input parameters to said first data processing system, said second data processing means comprising second processor means for executing coded instructions, second memory means for storing data and coded instructions, and second I/O means for facilitating input and output operations with respect to said second data processing means; and,

using data transmission means to connect said first I/O means and said second I/O means whereby said machine-related input parameters are transmittable from said second data processing means to said first data processing means; and, entering said machine-related input parameters into said second memory means using data entry means connected to said second data processing means.

52. The method of claim 51, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter that influences the selective feeding of documents from one of said insert processing stations.

53. The method of claim 52, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter that specifies that an insert processing station which performs the processing event of feeding documents into said insert track means is to selectively feed a document therefrom for inclusion with a related group of documents in accordance with sensed indicia provided on a control document belonging to said group.

54. The method of claim 52, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter that specifies that an insert

processing station which performs the processing event of feeding documents onto said insert track may feed a document therefrom for inclusion with a related group of documents if the feeding of said document will not increase the weight of said group of documents sufficiently to change the postal weight classification of said group of documents.

55. The method of claim 51, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter which is indicative of the per document weight of documents stored at one of said insert processing stations, and wherein said per document weight parameter is stored in said first memory means and utilized by said first data processing means in the calculation of a projected weight of a group of documents.

56. The method of claim 51, wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter which is indicative of a maximum number of documents which one of said insert processing stations is permitted to feed with respect to any one group of documents.

57. The method of claim 51, further comprising the step of:

providing sensing means at one of said insert processing stations which performs the processing event of feeding documents onto said insert track, said sensing means be adapted to for sense information relative to at least one document fed from said insert processing station, and wherein said machine-related input parameters downloaded from said second data processing means to said first data processing means includes a parameter indicative of whether said sensing means is to be utilized to sense said information.

58. The method of claim 57, wherein said first data processing means is configured to determine whether information sensed by said sensing means with respect to a document fed for inclusion with a particular group corresponds to information provided on a control document also belonging to said group.

59. The method of claim 51, further comprising the steps of:

positioning detector means with respect to said insertion machine for detecting the reaching of certain points in said machine cycle, said certain points in said machine cycle being related to the desired timing of the processing events performable by various ones of said processing stations; and, including in said machine related input parameters downloaded from said second data processing means to said first data processing means a parameter indicative of a point in said machine cycle at which it is desired for a processing station to perform its processing event.

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US006575358B2

(12) **United States Patent**
O'Callaghan et al.

(10) Patent No.: **US 6,575,358 B2**
(45) Date of Patent: ***Jun. 10, 2003**

(54) **AUTOMATIC VERIFICATION EQUIPMENT**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: 09/957,203

(22) Filed: Sep. 20, 2001

(65) **Prior Publication Data**

US 2002/0030095 A1 Mar. 14, 2002

Related U.S. Application Data

(63) Continuation of application No. 08/909,640, filed on Aug. 12, 1997, now Pat. No. 6,311,892.

(51) Int. Cl.⁷ G06F 17/00

(52) U.S. Cl. 235/375; 235/385; 235/470; 209/584

(58) Field of Search 235/375, 376, 235/381, 385, 435, 470; 209/584, 900

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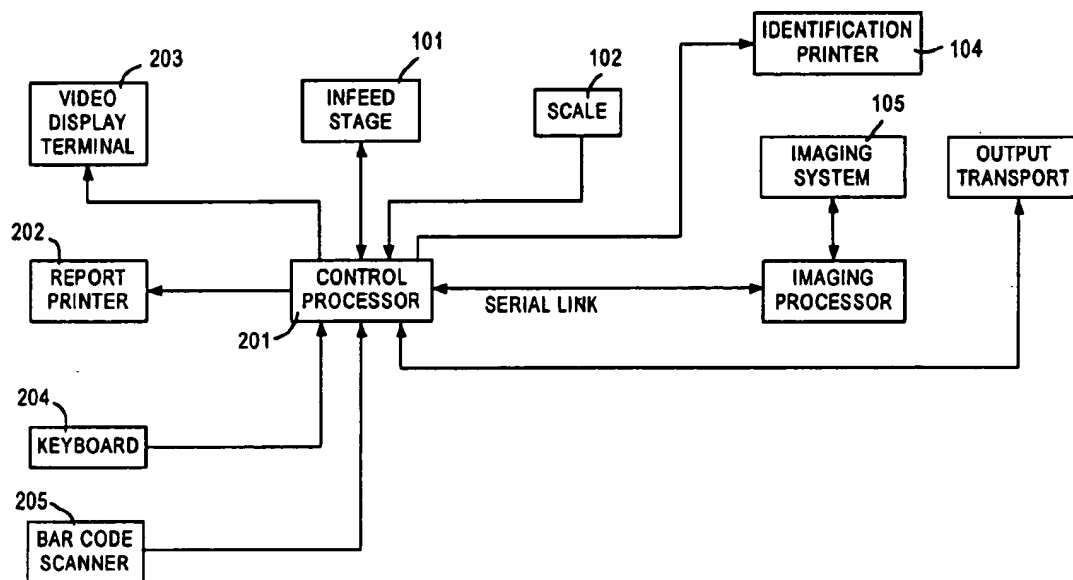
Primary Examiner—Daniel St.Cyr

(74) Attorney, Agent, or Firm—McDermott, Will & Emery

(57) **ABSTRACT**

Apparatus for automatically acquiring and verifying, relative to pre-established rules, information affixed to relatively flat articles transported along a transport path comprises weighing component device for measuring weight of articles being processed, image acquisition device for acquiring a representation of indicia appearing on an article, processing device for recognition of the indicia appearing on an article, and processing device for verifying acquired data against the pre-established rules.

24 Claims, 3 Drawing Sheets



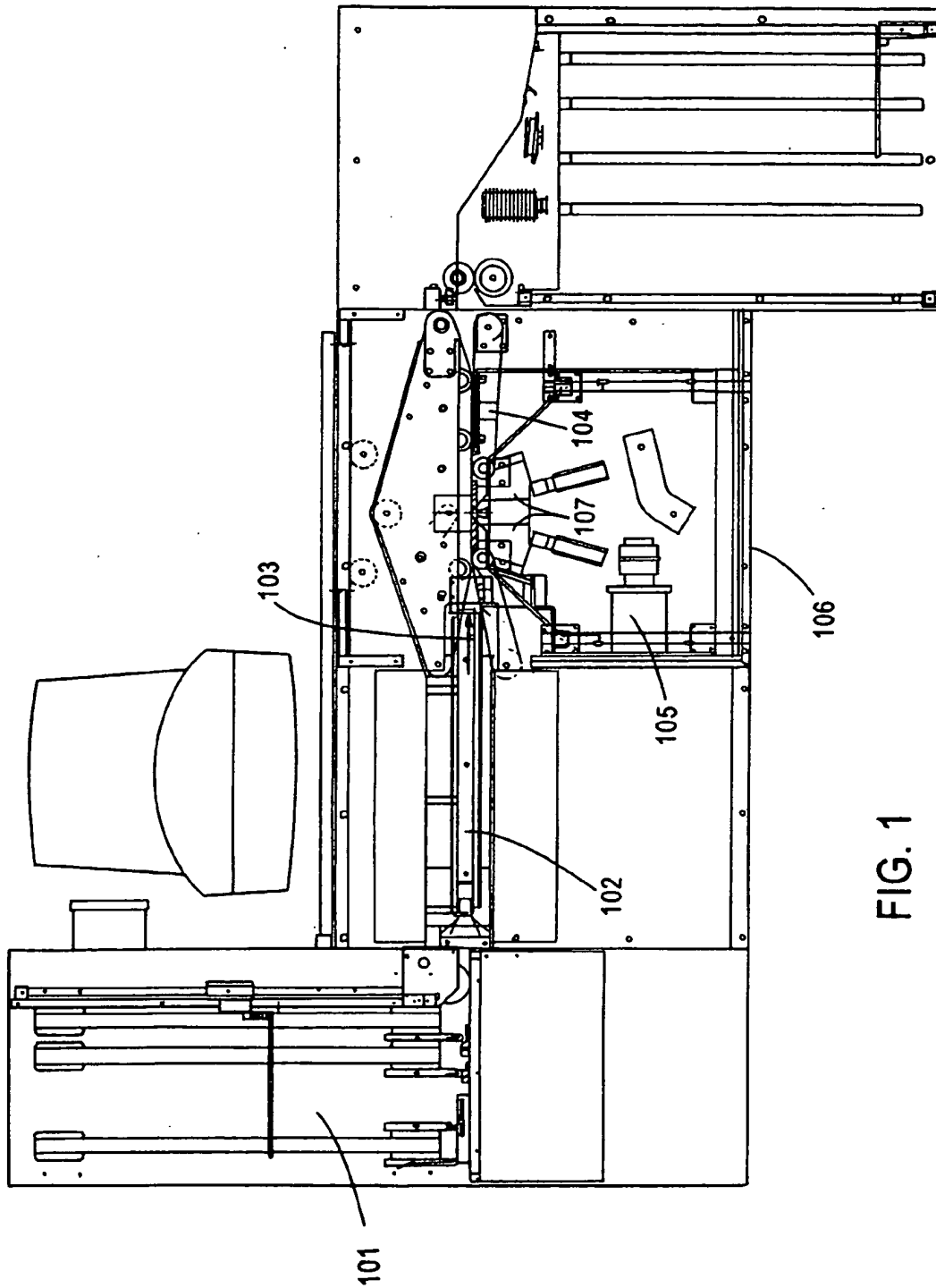


FIG. 1

FIG. 2

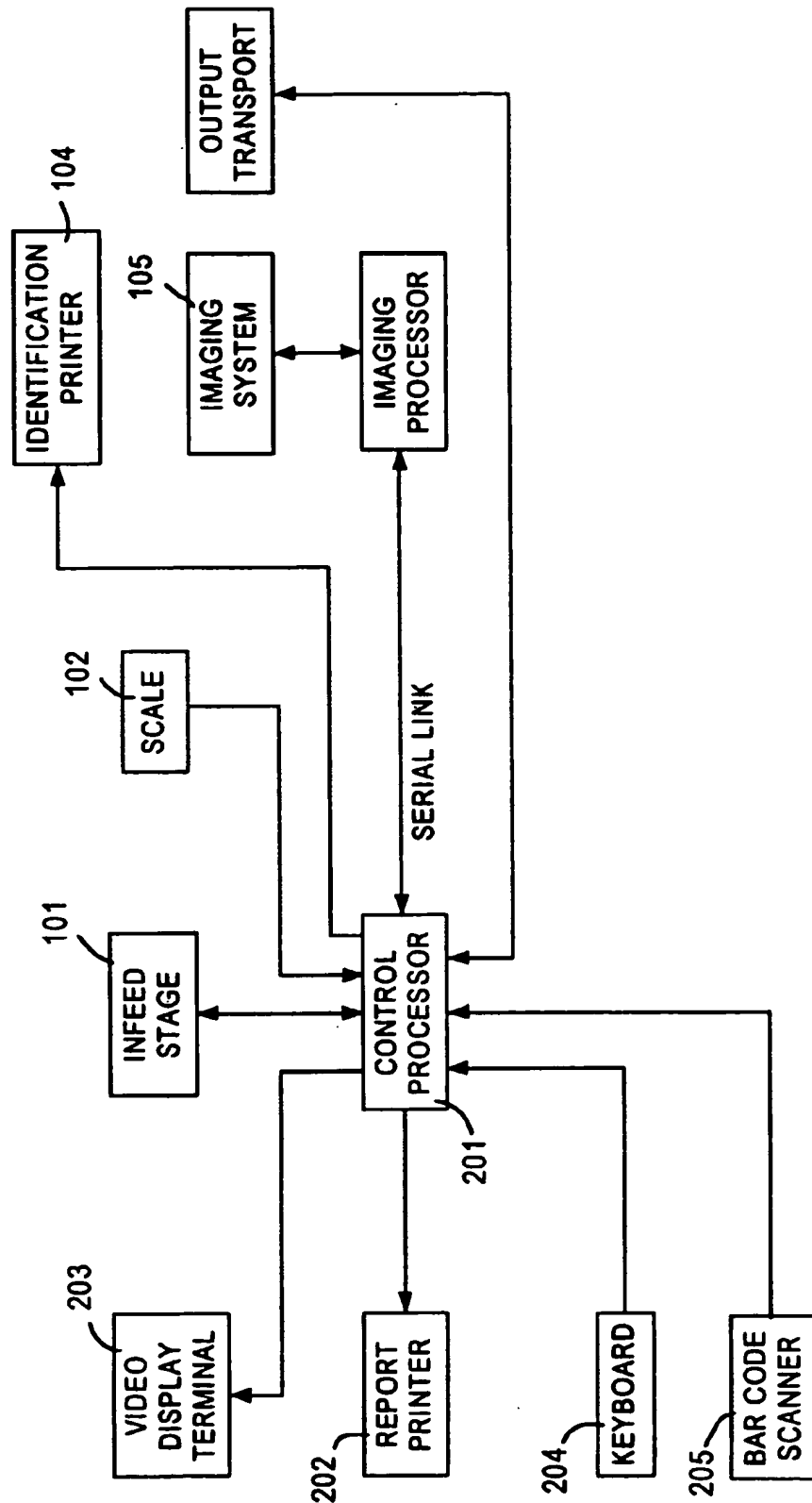


FIG. 3

OFFSET	MESSAGE	NUMBER OF BYTES	CHARACTER FORMAT	RESULT
0	<START_CHAR>	1 BYTE	ASCII	'#'
1	<SEQUENCE_NO>	2 BYTES	HEX / ASCII	'00' → 'FF'
3	<TYPE>	1 BYTE	ASCII	SEE TABLE 33-22.
4	<DATA>	N BYTES	(SEE INDIVIDUAL MESSAGES)	(SEE INDIVIDUAL MESSAGES)
4 + N	<CRC>	4 BYTES	HEX / ASCII	'0000' → 'FFFF'
8 + N	<STOP_CHAR>	1 BYTE	ASCII	'v'

FIG. 4

TYPE FIELD	MESSAGE NAME	COMMENTS
'A'	ACK	ACKNOWLEDGEMENT
'B'	CPC_IPC_BEGINRUN	GET READY TO BEGIN AN INSPECTION RUN.
'@'	CPC_IPC_DIAGNOSE	REQUEST DIAGNOSTIC TO BE RUN ON IPC.
'%'	IPC_CPC_- DIAGNOSTICRESPONSE	SENDS RESULT FROM A DIAGNOSTIC REQUEST
'Y'	ICP_CPC_FAULT	ASYNCHRONOUS FAULT DETECTED.
'N'	NACK	NEGATIVE ACKNOWLEDGEMENT
'O'	IPC_CPC_- POSTAGESCANRESULT	INFORMATION GLEANED FROM THE MAIL PIECE BY THE EXEGETICS IMAGING SOFTWARE.
'P'	CPC_IPC_POSTAGE	EXPECTED POSTAGE SENT TO IMAGING PC.
'Q'	IPC_CPC_BARCODE SCANRESULT	INFORMATION GLEANED FROM THE PIECE BARCODE OCR SCAN.
'R'	IPC_CPC_ADDRESS SCANRESULT	INFORMATION GLEANED FROM THE MAIL PIECE BY THE DALLAS IMAGING SOFTWARE.
'S'	CPC_IPC_SYNCHRONIZE	SYNCHRONIZE IPC WITH TIME STAMP.
'T'	CPC_IPC_TRAYDATA	TRAY TAG DATA
'V'	CPC_IPC_WEDGEDATA	SAMPLE WEDGE DATA

AUTOMATIC VERIFICATION EQUIPMENT

This is continuation application of U.S. application Ser. No. 08/909,640 filed Aug. 12, 1997, now U.S. Pat. No. 6,311,892, issued Nov. 6, 2001.

FIELD OF THE INVENTION

This invention relates generally to equipment for reviewing information printed on relatively flat articles, and for gathering information, such as weight, concerning these articles, and is more particularly directed toward automatic verification of postage and address information for articles to be mailed.

BACKGROUND OF THE INVENTION

Many corporations and organizations disseminate information and advertising material through the mail. In order to minimize the costs associated with this type of mailing, the United States Postal Service (USPS) offers bulk mailing rates that result in decreased cost of mailing for each piece of mail. Certain types of preprocessing by bulk mailing organizations, such as presorting of bulk mail into lots by ZIP code, helps the USPS in mail sorting and leads to further discounts in the cost of mailing for bulk mailing organizations.

Of course, because of the large volume of bulk mail, the USPS would lose considerable revenue if bulk mailing organizations failed to comply strictly with their presorting obligations but still tried to take advantage of lower postal rates. It is also possible, through error, that a bulk mailer may apply insufficient metered postage to articles of mail. In addition, the USPS must have some form of quality control and verification to ensure that bulk mailers' presort efforts are accurate, so that improperly sorted bulk mail does not slow down the operation of USPS sorting activities.

Traditionally, this verification process is performed manually (with the exception of barcode verification). This manual verification process is very labor intensive and prone to error. Accordingly, a need arises for an automated verification system that is capable of processing large volumes of mail with speed and accuracy, and that maintains proper records relating to each bulk mailer for which verification operations are conducted.

SUMMARY OF THE INVENTION

These needs and others are satisfied by the verification apparatus of the present invention. In accordance with the invention, apparatus for automatically acquiring and verifying, relative to pre-established rules, information affixed to relatively flat articles transported along a transport path comprises weighing means for measuring weight of articles being processed, image acquisition means for acquiring a representation of indicia appearing on an article, processing means for recognition of the indicia appearing on an article, and processing means for verifying acquired data against the pre-established rules.

The apparatus may further comprise infeed means for transporting the articles from an input stage to subsequent processing stages. The infeed means may comprise an infeed conveyor mechanism that singulates articles for subsequent processing.

In accordance with one aspect of the invention, the weighing means comprises an in-line scale that weighs articles individually. The apparatus may further comprise identification printing means for applying numeric identifi-

cation to at least some of the articles. The printing means may comprise an ink jet print head disposed along the transport path.

In one form of the invention, the image acquisition means comprises a CCD camera and illumination means. The illumination means comprises a plurality of support structures housing light-directing fibers.

In another aspect of the invention, the processing means for recognition of the indicia appearing on an article returns postage information relating to postage type, wherein postage type is selected from the group of postage types consisting essentially of meter, permit, and stamp. The processing means for recognition of the indicia appearing on an article may return postage value, postage class, address information, and various kinds of barcode information such as barcode decode value and barcode print quality information. Both the processing means for recognition of indicia appearing on an article and the processing means for verifying acquired data may comprise a microcomputer.

In yet another aspect of the invention, the apparatus may further comprise stacking means for re-collecting articles. In general, the articles disposed along the transport path are arranged in an original order and orientation, and the stacking means re-collects the articles in the original order and orientation.

In still another form of the invention, the pre-established rules may include a number of parameters such as bar code print quality, compatibility of bar code decode value and address information, weight restrictions, postage type restrictions, postage value restrictions, postage class restrictions, and destination sort requirements. Sort requirements may be valid for a current sort data base, or for one or more prior databases.

In still another aspect of the present invention, verification results are printed as reports in a predetermined format. The apparatus may further comprise scanning means for automatic reading of bar codes associated with groups of articles.

In yet another form of the invention, apparatus for automatically acquiring, storing, and verifying indicia affixed to relatively flat articles comprises infeed means for transporting articles from an input stage to subsequent processing stages, weighing means for measuring weight of articles being processed, printing means for affixing identifying indicia to each article, image acquisition means for acquiring a representation of selected indicia appearing on each article, control processor means for controlling acquisition, storage, and verification, and image processing means, in communication with the control processing means, for synchronization of acquisition, storage, and verification.

The infeed means preferably comprises an infeed conveyor mechanism that singulates articles for subsequent processing. The weighing means may comprise an in-line scale that weighs each article individually, and the printing means comprises an ink jet print head disposed proximate to the image acquisition means. The image acquisition means preferably comprises a CCD camera and illumination means.

In one form of the invention, the illumination means comprises a plurality of support structures housing light directing fibers. The control processor means comprises a microcomputer controller in communication with the image processing means, while the control processor means communicates with the image processing means via a serial communications protocol. The image processing means is preferably a microprocessor controller in serial communication with the control processor means.

In accordance with one aspect of the invention, apparatus for processing and verifying indicia disposed upon articles to be mailed comprises an infeed magazine in communication with a transport mechanism defining a transport path for the articles, a weighing station receiving articles from the transport mechanism and weighing each article individually, an ink jet printer disposed along the transport path, the ink jet printer applying a numeric identification to each article, a camera unit positioned along a scanning locus that scans the indicia disposed on each article and stores image information in an associated memory, an illumination mechanism associated with the camera unit, providing illumination directed toward the scanning locus, and a control processor and an image processor interconnected by a serial communication link, the control and image processors synchronizing data acquisition, storage, and comparison for verification of indicia disposed upon the articles.

In one form of the invention, the serial communication link comprises a bi-directional serial link over which commands, status messages, and data packets are exchanged. The bi-directional serial link comprises an RS-232 serial link at approximately 19,200 baud. Serial messages are exchanged over the serial communication link, and each serial message begins with a predetermined start character and ends with a predetermined stop character. Preferably, the start character and stop character are 1 byte ASCII characters.

In yet another aspect of the invention, each serial message includes cyclic redundancy check information and a sequence number. Each message is acknowledged by the recipient through transmission of an acknowledgment message when the message is received correctly, and each incorrectly received message causes a negative acknowledgment message to be transmitted. Preferably, the sender resends a message at least once if an acknowledgment message is not received within a predetermined time. Each acknowledgment message includes the sequence number.

Further objects, features, and advantages of the present invention will become apparent from the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates the components of an automatic verification system in accordance with the present invention;

FIG. 2 is a block diagram of an automatic verification system in accordance with the present invention illustrating interconnection of system elements;

FIG. 3 is a table depicting a serial message format suitable for intercommunication in the automatic verification system of FIG. 2;

FIG. 4 is a table showing permissible message types under the serial format depicted in FIG. 3;

DETAILED DESCRIPTION OF THE INVENTION

In accordance with the present invention, an automatic verification system is described that provides distinct advantages when compared to verification processes of the prior art. The invention can best be understood with reference to the accompanying drawing figures.

The automatic verification system of FIG. 1, generally depicted by the numeral 100, has a capacity to accommodate one full (two-foot) letter tray of mail, and will feed trays of either letter or flat mail in excess of 6,000 pieces per hour. The infeed magazine 101 that provides this capability will

process one tray of mail per run. From the feeder 101, each mailpiece proceeds into a scale/settling station 102. This station 102 weighs each piece of mail individually, and then correctly registers the bottom edge of the mailpiece onto an associated transport plate.

Supported by pinch belts, each mailpiece proceeds along the transport path 103, where a 15 inch, high-resolution camera 105 captures an image of the piece for further processing. An ink jet printer 104 is then used to spray a numeric identification (ID) on each piece. The piece is then stacked in its original order and orientation, while an intelligent tracking system ensures quality and accuracy of inspection.

The block diagram of FIG. 2 depicts a control processor 201 that provides a user interface prompting the operator to perform specific actions, such as inputting data, loading the magazine, starting the transport mechanism, etc. After the operator enters all parameters, the required information is automatically measured. Measurement results are used to calculate and display bulk postage rate, total weight of mailing, number of sample units, error factor, percent error, additional postage due, and other relevant metrics.

With a throughput of 6,000 pieces per hour, the automatic verification system feeder unit 101 offers a reliable and powerful transport system. Mail pieces are directed from the feeder into the scale unit 102 that weighs individual mail pieces in line at a full 6,000 pieces per hour rate. After the weighing operation, the mail pieces are scanned by the camera unit 105.

The camera unit 105 is a premier ultra-high density line scan array CCD (charge coupled device) camera. The camera 105 will scan at a rate of at least 200 scan lines per inch. This high resolution enables the automatic inspection system 100 to accurately determine Postnet barcode quality and to read address information from each mailpiece to verify barcode and postage data and to add other relevant information to the associated mailpiece data base. The system includes the capability to update and modify the data bases as required. After the scanning operation, an ink jet printer 104 prints identification information on each mail piece. The print head of the ink jet printer unit 104 is preferably positioned in proximity to the camera unit 105 for ease of mounting.

The system may further include a report printer 202 that presents the results of the verification process to an operator in hard-copy format. A plurality of reports may be made available, and the reports may be structured to match existing customer report formats or may be custom designed for particular applications. The system may also incorporate a video display terminal 203 for use in job set-up, input of parameters, and display of results.

The video display terminal 203 may also be used for the display of images acquired by the system during verification operation. At the operator's option, the video display terminal may display the image acquired by scanning a particular mailpiece, and may indicate, via colored rectangles, shadings, etc., selected words, individual characters, address block location, stamp, or other indicia that has been determined by the image processing recognition software.

The camera scan field is illuminated by a high-intensity light system 106 in which optical fibers arrayed in associated lighting towers 107 direct light from a centrally located high-intensity lamp sub-system. A dense, random array of optical fibers within each tower 107 allows for bright, even illumination within the scan area.

The system assigns each mailpiece to a data file that individually registers each mailpiece. As the mailpiece is

processed, the weight of each piece and the associated numeric identification number that is applied to the mail-piece by the ink jet printer are also recorded in the file. The image that is scanned by the camera unit is also processed and filed.

The scanned image is processed by identifying the address block on the mail piece, reading the address, and verifying the address information. The system registers the corresponding barcode value to the file, reads the stamp value and stores its marking, and scans the barcode in detail to ensure that the print quality meets USPS specifications. The system identifies the existence, if any, of a postage meter imprint and the value of postage it represents, and the existence and identification of a permit imprint. The printed bar code value and quality assessment are also stored in the file for the associated mailpiece. At this point, the individual mailpiece file includes the ID number that has been printed on the mailpiece by the ink jet printer, the weight, stamp value, any existing endorsement, the address barcode value, the printed barcode value, and the quality of the barcode/ZIP code. The system identifies and verifies the accuracy of the printed barcode against the results of an address search within its address data base, and verifies that such aspects of the mail as postage paid, weight, etc., are consistent with the information provided by the mailer.

To aid in the acquisition of tray tag information, the verification system may incorporate a bar-code scanner 205 that reads the tray tag information. The tray tag information is generally expressed as a printed bar code on a tray or container of mail or other flat articles awaiting processing by the system. The tray tag generally includes information related to the contents of the tray, and thus defines a set of pre-established rules to which the articles must conform.

The verification process includes comparing information input to the system via keyboard 204, tray tag bar code scanner 205, scale 102, image acquisition and processing 105, and internal data bases to determine whether the pre-established rules have been followed.

The automatic verification system operates under the control of a Control Personal Computer (CPC) in communication with an Imaging Personal Computer (IPC). Communication between the CPC and IPC takes place over a bi-directional serial link that provides transfer of commands, status, and data packets in both directions.

The hardware interface between the CPC and IPC is an RS-232 serial link that is well-known in the applicable art. The hardware protocol calls for full duplex asynchronous transmissions at 19,200 baud with 1 start bit, 8 data bits, 1 stop bit, and no parity.

All serial messages between the IPC and CPC follow a predetermined format that is illustrated in FIG. 3. All messages begin with the START_CHAR and end with the STOP_CHAR. Each digit or character is sent using 8-bit ASCII (American Standard Code for Information Interchange). This is to ensure the ability to regain message synchronization if any characters are lost. The least significant bit of each byte is transferred first, in accordance with the ASCII standard. The CRC is a cyclic redundancy check computed by the sender and the recipient to make sure that no errors have occurred during transmission. It is formed using a selected CCITT polynomial, as is well-known, and is computed over the range of characters from SEQUENCE_NO through DATA. The 16-bit CRC is converted to ASCII using hexadecimal notation and stored in the 4 bytes at CRC. All message types are composed of ASCII characters (alphabetic characters are preferred). This

facilitates debugging with a serial line analyzer. BCD (binary coded decimal) data are transferred most-significant byte first. A message may have no data bytes. This minimum size of a message is nine (9) bytes. The various permissible message types are illustrated in FIG. 4.

Each message is acknowledged by the recipient with an ACK (acknowledgment message). An ACK informs the sender that the message has been received successfully, is understood, and is being acted upon. The sender of the original request knows to expect an ACK in response to its request. It is up to the sender to wait for this response.

A NACK (negative acknowledgment message) tells the sender that the message is either not understood or not supported by the receiver. A NACK never happens if the serial interface has performed successfully and the message sent was properly formatted.

The sender does not send another request message until the previous request has been ACKed or has timed out. The sender generally retries sending a message up to two (2) times if it has not been ACKed within a predetermined time period. The sender stamps each message with a unique sequence number. This number is generated from an internal 8-bit counter that is incremented after each message transaction, and is allowed to roll over from 0xFF to 0x00. The receiver echoes this sequence number back in the ACK/NACK response to this message. The sender uses the same sequence number on retries.

In general, the CPC updates the IPC with the Mail Piece Identification Number (MPID), the Mail Piece Weight Data (MPWD), and its time stamp. In response, the IPC replies with information that was received by the scanned mail piece. The messages that are normally sent from the CPC to the IPC are summarized below:

1. Synchronization Message—This message is sent when a sensor mounted near the camera array detects a mailpiece within the camera zone.

2. Postage Message—This message is sent when the scale sub-system has completed weighing a piece of mail. This message conveys to the IPC the amount of postage this mailpiece is expected to contain. It is derived from the weight of the mailpiece and knowledge of the characteristics of the type of mailing being verified. In most cases, a postage rate derived from standard (or bulk rate) USPS postage rate schedules will be used. The only exception occurs when the image processing indicates that the mail piece is non-profit in nature. In that event, a special non-profit postage field included with the Postage Message is used to determine the expected postage for the mailpiece.

3. Begin Run Message—This message is sent at the start of a run to direct the IPC to clear its buffers and prepare for the start of an inspection run. Additional information is also passed to the IPC regarding the statistics for the mailing, such as time of mailing, payment method to be used, the mailer's permit or meter number, and the weight of a single piece of mail (in the event that the mailing is being made at an Identical Weight Rate).

4. Tray Label Message—This message is sent by the CPC to pass information taken from the tray label on the mailing tray that contains the mailpieces that are being examined. This information includes the tray label bar code, the tray ZIP code, destination city and state, and class and sub-class of mail in the tray.

5. Wedge Data Message—This message conveys the relevant information from a sample wedge (a predetermined quantity of mail concerning which characteristics are known).

The IPC also transmits messages to the CPC. Among the IPC-transmitted messages are the following:

1. Address Scan Result Message—This message sends a formatted set of parameters back to the CPC. The referenced mail piece ID is transmitted along with the mailpiece ZIP code appearing on the mail piece and the ZIP code derived from the address information on the mailpiece.

2. Postage Scan Result Message—This message sends a formatted set of parameters from the IPC back to the CPC. The referenced mailpiece ID is transmitted along with the mailpiece postage meter date, the mailpiece payment method, and the mailpiece amount paid.

3. Barcode Scan Result Message—In this message, the IPC transmits the reference mailpiece ID, the mailpiece barcode, and a measure of barcode readability.

Both the CPC and the IPC are capable of transmitting ACK and NACK messages, both initiating and responding to diagnostic messages, and transmitting error indication messages.

There has been described herein an automatic verification system that is relatively free from the shortcomings of verification processes of the prior art. It will be apparent to those skilled in the art that modifications may be made without departing from the spirit and scope of the invention. Accordingly, it is not intended that the invention be limited except as may be necessary in view of the appended claims. What is claimed is:

1. An apparatus for determining whether a batch of presorted mailpieces conforms to presort parameters identified by associated tray mailing information for said batch of presorted mailpieces, said apparatus comprising:

- an input device for receiving said identified presort parameters;
- a scale for weighing said mailpieces;
- an image acquisition device for capturing postage information and address information affixed to said mailpieces; and
- a processor for analyzing said postage information and address information with respect to said identified presort parameters to determine whether at least one of said postage information and said address information corresponds to said identified presort parameters.

2. The apparatus of claim 1, wherein said identified presort parameters includes a barcode print quality restriction, and wherein said address information includes a barcode, such that said processor determines whether said barcode on each of said mailpieces conforms to said barcode print quality restriction.

3. The apparatus of claim 2, wherein said processor determines an error factor based upon a number of conforming and non-conforming mailpieces, and determines an additional postage due amount based upon said error factor.

4. The apparatus of claim 1, wherein said identified presort parameters includes a barcode decode value compatibility restriction, and wherein said address information includes an address and a barcode having a barcode decode value, such that said processor determines whether said barcode decode value is compatible with said address, to determine whether said mailpieces conform to said barcode decode value compatibility restriction.

5. The apparatus of claim 1, wherein said identified presort parameters includes a weight restriction, and wherein each of said mailpieces has a weight, such that said processor determines whether said weight of each of said mailpieces conforms to said weight restriction.

6. The apparatus of claim 1, wherein said identified presort parameters includes a postage type restriction, and

wherein said postage information includes a postage type, such that said processor determines whether said postage type on each of said mailpieces conforms to said postage type restriction.

7. The apparatus of claim 6, wherein said postage type is meter, permit or stamp.

8. The apparatus of claim 6, wherein said processor determines an error factor based upon a number of conforming and non-conforming mailpieces, and determines an additional postage due amount based upon said error factor.

9. The apparatus of claim 1, wherein said identified presort parameters includes a postage value restriction, and wherein said postage information includes a postage value, such that said processor determines whether said postage value on each of said mailpieces conforms to said postage value restriction.

10. The apparatus of claim 1, wherein said identified presort parameters includes a postage class restriction, and wherein said postage information includes a postage class, such that said processor determines whether said postage class on each of said mailpieces conforms to said postage class restriction.

11. The apparatus of claim 1, wherein said identified presort parameters includes a zip code presort restriction, and wherein said address information includes a zip code, such that said processor determines whether said zip code on each of said mailpieces conforms to said zip code presort restriction.

12. The apparatus of claim 11, wherein said processor determines an error factor based upon a number of conforming and non-conforming mailpieces, and determines an additional postage due amount based upon said error factor.

13. A method for determining whether a batch of presorted mailpieces conforms to presort parameters identified by associated tray mailing information for said batch of presorted mailpieces, said method comprising the steps of:

- receiving said identified presort parameters;
- weighing said mailpieces;
- capturing postage information and address information affixed to said mailpieces; and
- analyzing at least one of said postage information and address information with respect to said identified presort parameters to determine whether at least one of said postage information and said address information corresponds to said identified presort parameters.

14. The method of claim 13, wherein said identified presort parameters includes a barcode print quality restriction, and wherein said address information includes a barcode, said method further comprising the step of determining whether said barcode on each of said mailpieces conforms to said barcode print quality restriction.

15. The method of claim 14, wherein said method further comprising the steps of determining an error factor based upon a number of conforming and non-conforming mailpieces, and determining an additional postage due amount based upon said error factor.

16. The method of claim 13, wherein said identified presort parameters includes a barcode decode value compatibility restriction, and wherein said address information includes an address and a barcode having a barcode decode value, said method further comprising the step of determining whether said barcode decode value is compatible with said address, to determine whether said mailpieces conform to said barcode decode value compatibility restriction.

17. The method of claim 13, wherein said identified presort parameters includes a weight restriction, and wherein each of said mailpieces has a weight, said method

9

further comprising the step of determining whether said weight of each of said mailpieces conforms to said weight restriction.

18. The method of claim 13, wherein said identified presort parameters includes a postage type restriction, and wherein said postage information includes a postage type, said method further comprising the step of determining whether said postage type on each of said mailpieces conforms to said postage type restriction.

19. The method of claim 18, wherein said method further comprising the steps of determining an error factor based upon a number of conforming and non-conforming mailpieces, and determining an additional postage due amount based upon said error factor.

20. The method of claim 18, wherein said postage type is meter, permit or stamp.

21. The method of claim 13, wherein said identified presort parameters includes a postage value restriction, and wherein said postage information includes a postage value, said method further comprising the step of determining

10

whether said postage value on each of said mailpieces conforms to said postage value restriction.

22. The method of claim 13, wherein said identified presort parameters includes a postage class restriction, and wherein said postage information includes a postage class, said method further comprising the step of determining whether said postage class on each of said mailpieces conforms to said postage class restriction.

23. The method of claim 13, wherein said identified presort parameters includes a zip code presort restriction, and wherein said address information includes a zip code, said method further comprising the step of determining whether said zip code on each of said mailpieces conforms to said zip code presort restriction.

24. The method of claim 23, wherein said method further comprising the steps of determining an error factor based upon a number of conforming and non-conforming mailpieces, and determining an additional postage due amount based upon said error factor.

* * * * *



US006119051A

United States Patent [19][11] **Patent Number:** **6,119,051****Anderson, Jr. et al.**[45] **Date of Patent:** **Sep. 12, 2000**

[54] **CLIENT-SERVER SYSTEM, METHOD AND COMPUTER PRODUCT FOR MANAGING DATABASE DRIVEN INSERTION (DDI) AND MAIL PIECE TRACKING (MPT) DATA**

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[73] **Assignee:** Bell & Howell Mail and Messaging Technologies Co., Durham, N.C.

[21] **Appl. No.:** 09/183,811

[22] **Filed:** Oct. 30, 1998

Related U.S. Application Data

[60] Provisional application No. 60/105,804, Oct. 27, 1998.

[51] **Int. Cl.**⁷ G06F 7/00

[52] **U.S. Cl.** 700/221; 700/226

[58] **Field of Search** 700/220, 221, 700/223, 224, 226; 395/200.33; 270/58.31, 52.19; 209/584, 583, 900, 939

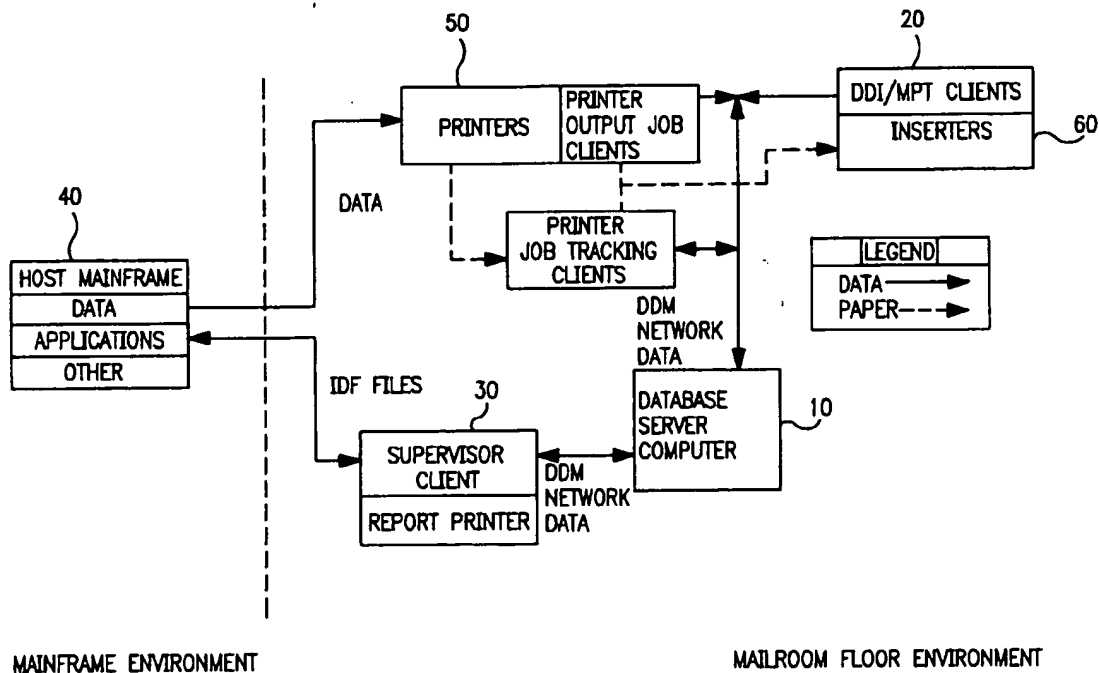
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[57] ABSTRACT

A client/server architecture for database driven insertion and mail piece tracking system, method, and computer program product is disclosed. A database is populated with database driven insertion data comprising instructions for handling mailpiece material. A server manages the database by responding to requests for mail processing instructions from clients and storing mailpiece data received from clients. A scanning device reads key code marked mailpiece material in which the key code corresponds to a database location containing instructions for handling mailpiece material. A client processor receives the key code from the scanning device, and transmits a request to the server for accessing the database location containing the instructions for handling mailpiece material. The server retrieves the instructions for handling mailpiece material, and transmits the instructions to the client. The client causes the performance of a mail processing task in accordance with the instructions, gathers mailpiece tracking data as the mailpiece material is processed, and forwards mailpiece tracking data to the server. The database information is accessible to report writing and generating software applications which cull data pertaining to a given mail processing job into a desired format.

20 Claims, 1 Drawing Sheet



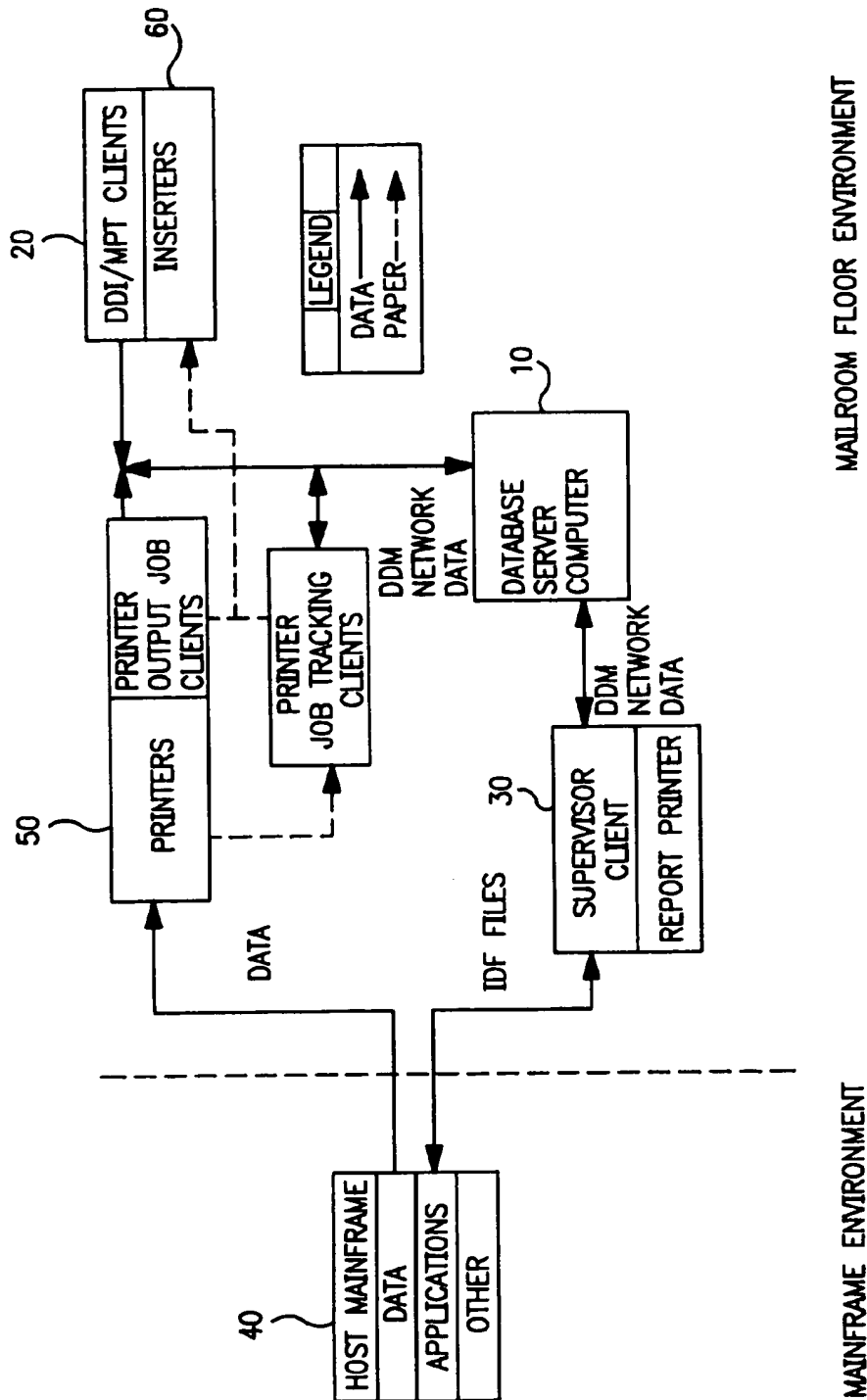


FIG. 1

CLIENT-SERVER SYSTEM, METHOD AND COMPUTER PRODUCT FOR MANAGING DATABASE DRIVEN INSERTION (DDI) AND MAIL PIECE TRACKING (MPT) DATA

CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to and claims the benefit of the U.S. Provisional Patent Application entitled "A Client-Server System and Method Of Managing Database Driven Insertion (DDI) and Mail Piece Tracking (MPT) Data", filed on Oct. 27, 1998, 60/105,804.

FIELD OF THE INVENTION

The present invention relates generally to manufacturing environments that wish to relate large amounts of information to a small identifier. More specifically, the present invention relates to a client-server system, method, and computer program for managing database driven insertion (DDI) and mail piece tracking (MPT) data for holding and managing mailroom data in a consistent and easy to use manner.

BACKGROUND OF THE INVENTION

Currently, it is common in mail processing for mail piece data to be handled utilizing a file-based system (i.e. using a flat ASCII file to hold all database driven insertion and mail piece tracking information). A client/server concept involves replacing flat files with a database server which maintains indices and relations between various data fields, as described further hereinbelow. Also as described further hereinbelow, utilizing a client-server concept, as according to the present invention, allows an interface to be developed for client programs to be able to read database driven insertion (DDI) data from the database and write mail piece tracking data back to the database.

Database driven insertion (DDI) is currently being accomplished in conventional mail processing by storing mail processing instructions in a flat ASCII file, reading an account number from paper via a laser scanner, calculating the offset of the data in the file that corresponded to the account number read, and reading the data at that offset point into the mail processing equipment. Mail piece tracking has been accomplished by storing information about a mailpiece back into the database driven insertion (DDI) file, or possibly a separate file whenever the mailpiece processing was complete. This was, and still is, the industry norm because it is believed that a database is not capable of keeping up with the read and write rates required for multiple mail processing machines. In contrast to this norm, the present invention, however, can and does keep up with the read and write rates required for multiple mail processing machines using the aforementioned client/server concept, as described further hereinbelow.

Database driven insertion (DDI) data typically describes to individual mail processing inserters which inserts to feed, how many sheets are in an account, what actions the inserter is to perform on the account, what address should be printed on the envelope, and/or other information as apparent to those of skill in the art.

Mail piece tracking (MPT) data typically describes what actually happened to the account during processing, i.e. what machine processed it, when the machine started processing it, when the machine finished processing it, which operators were running the machine, which inserts fed, and/or other information as apparent to those of skill in the art.

Using a database under a client/server architecture (as opposed to a flat ASCII file) for insertion and tracking has many significant advantages which will be readily appreciated by those of skill in the art. Clients (which can comprise mail inserters, mail sorters, printers, other applications, and/or other suitable clients as recognized by those of skill in the art of mail processing) can request and receive only the information they need which decreases the overall load borne by the communications network. Other clients (report generators) can create reports much easier with well known database reporting tools. The server provides a common repository for all mail piece tracking and database driven insertion data, which, in turn, allows management from one computer and location, i.e. centralized operation. The database server provides excellent file locking and read/write contention protection superior to that of ASCII flat files. The server also provides services to inform clients whether a record was updated "underneath" it. This provides site-wide duplicate checking for all mailpieces to ensure there are no duplicate mailpieces being processed. Additionally, the database server enforces data consistency. The server will not allow clients to write "invalid" data into the database. This is very difficult to enforce in file-based systems. The server further provides "stored procedures" which allow the server to change its functionality without necessarily modifying client code. Other advantages can also exist as recognized by those skilled in the art.

In view of the above, there remains much room for improvement in the art, particularly for a new system and method of "publishing" and "recording" database driven insertion and mail piece tracking data.

DISCLOSURE OF THE INVENTION

In accordance with the present invention, a novel client-server system, method, and computer program for managing database driven insertion (DDI) and mail piece tracking (MPT) data for holding and managing mailroom data in a consistent and easy to use manner is provided. "Managing" of data according to the present invention refers to a system that controls, utilizes, tracks, and reports on all aspects of database driven insertion and mail piece tracking data. By the client/server database architecture for managing database driven insertion and mailpiece tracking in a mail processing environment according to this invention, a customer initially sets up a mail processing site by defining within the client/server architecture running database driven insertion and mail piece tracking system parameters such as Users, Privileges, JobSetups, Materials, etc., before any actual mail processing occurs. Next, the customer generates data (generally in a mainframe environment) that is intended to be printed and mailed. The data is run through a utility like Bell & Howell's *Transformer*TM or their own custom software to create a "side file" that contains the database driven insertion information required by a mail processing insertion device. Each print run has a matching side file generated for it. Material is printed and the side file is loaded/inducted into the database driven insertion and mail piece tracking system. The customer physically conveys the printed material to the inserter, loads the mail processing job currently programmed, places the materials called for by the mail processing job (e.g., inserts, printed materials, envelopes, etc. . . .) into the correct locations, and begins running the mail processing job. As a mail processing inserter reads each reader code or key that has been strategically placed on the mailpiece materials, the inserter makes a request for the database driven insertion data associated with that particular key from the database. The database

sends the insertion data back to the inserter, which uses the data to determine what actions to perform on this particular account. As each mailpiece leaves the inserter, mail piece tracking data is written into the database associated with each database driven insertion record that records, for instance, the Machine, Operators, Time, Date, JobSetup, Inserts Fed, etc., for each mailpiece.

It is therefore an object of the present invention to provide a novel client-server system, method, and computer program for managing database driven insertion (DDI) and mail piece tracking (MPT) data for holding and managing mailroom data in a consistent and easy to use manner.

It is another object of the present invention to store all types of data in the database driven insertion server that are related to the other types of data in a way that makes generating very flexible and detailed reports very easy.

It is a further object of the present invention to be able to modify instructions regarding the processing of each mailpiece right up until the time the mailpiece is placed on a machine for processing.

It is a still further object of the present invention to generate a standard postal manifest that details all pieces processed and the amount owed the post office.

It is a still further object of the present invention to re-produce a list of mailpieces processed properly and mailpieces that did not process properly.

Some of the objects of the invention having been stated, other objects will become evident as the description proceeds, when taken in connection with the accompanying drawings described below.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing advantages and features of the present invention will be appreciated more fully from the following description with reference to the accompanying drawings in which:

FIG. 1 illustrates a client/server architecture capable for use with the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

The present invention now is described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

Referring now to FIG. 1, one possible client/server architecture is shown which includes a database server computer 10 used as the central repository of all data, a machine client computer (console) 20, a supervisory computer (supervisor) 30, and a computer network for operatively linking everything together. Solid lines represent electronic data flow while dashed lines represent physical paper or material flow throughout FIG. 1. The preferred embodiment presently uses Microsoft Windows™ NT Server 4.0 software, Interbase™ Server 5.0, and custom written software running on the server machine and Interbase™ client software and/or custom written software running on the client machines. The hardware is generally Intel Pentium™ II class generic personal computer boxes.

It is to be understood that the present invention illustrated herein is readily implementable by those of ordinary skill in

the art as a computer program product having a medium with a computer program embodied thereon. The computer program product is capable of being loaded and executed on the appropriate computer processing device(s) in order to carry out the method or process steps described.

Still referring to FIG. 1, applications on the mainframe side send print images from a host mainframe 40, for instance, to printers 50, and IntellaSert™ Data File (IDF) data to the database server computer 10. Once the material is printed on by the printers 50 (which can be monitored by a reconciliation station), the printed paper is presented to mail processing finishing equipment, such as, for instance, mail processing inserters 60. The mail processing finishing equipment 60 requests information about the accounts it is about to process from the database server 10, using a small key encoded in the account barcode, and uses the information in the data file to continue processing the account. When the account has been completely processed (either rejected, removed, or ready to mail), the finishing equipment 60 updates the database with a complete disposition of the account. The exact status and location of each account is available at all times to users having access to the supervisor client computer 30. Once processing has been completed, the supervisor client computer 30 can create a manifest to present to the United States Postal Service (USPS), and for any pieces that were destroyed during processing, it can feed the pertinent data back to the host to generate reprint material and new IDF data. Alternately, supervisor client computer 30 can send data to a local "Winsert"-type mail processing device to create reprints locally. This allows accounts to be handled in a totally "closed loop" fashion.

The description of the present invention describes services provided by the database server computer 10 and application interfaces provided for client applications. These services are intended to provide all the basic services available in the software system design, including data file, database driven insertion, historical reports, real time monitoring of machinery, operators, jobs, shifts, inserts tracking and chargeback, manifesting, reprinting, and/or other suitable services apparent to those of skill in the art, while adding the ability to significantly extend the feature set, all without harming backwards compatibility.

A dataset, according to the present invention, is a named compilation of related data stored on the server. Datasets are composed of ordered records, which are accessed by a record identifier. Conceptually, datasets can be envisioned as virtual files which support normal file services such as create file, open file, close file, delete file, read record, write record, and append record. Additionally, datasets have the ability to delete records, provide multiple views of records, create a new dataset based on an existing dataset, and some search criteria among other abilities. All datasets have one thing in common, namely, each dataset record has an attribute called "RecordID". The "RecordID" field defines the order of records in a dataset. The attribute "RecordID" may be stored inside the record, or may be implicitly designed by the dataset itself. In either case, users of a dataset need only know that every record "knows" its position, and every dataset "knows" its order.

A record is the basic element of a dataset. This is the smallest element that can be modified in a dataset. Note that a record from a client point of view, and a record from a server point of view may be different for both the read and write cases. Clients may view a record as only a very small number of fields, whereas the server may actually have many fields for every record. As long as the client fields are a subset of the server fields, the server will send only the fields requested back to the client.

A RecID is the basic "key" column for any dataset. The word "key" is emphasized, because this in no way implies that datasets are indexed databases. It is meant to infer the function of a key field. All dataset records have a RecordID which starts at 1, and increases sequentially allowing elements of the dataset to be accessed by clients using the read record, update record, delete record, insert record, append record, open dataset, close dataset, seek record, and tell record type methods available in the standard "C" File/IO function set. Note that the actual order of data records in the dataset is both unknown and irrelevant. Unknown because the server can implement it in any way it chooses, and irrelevant because the server's only constraint on returning the dataset record to the client is that it happens "fast enough".

Views are defined by the services layer to provide data of interest from a dataset. A view defines all the fields needed from a record in a dataset. A record in a dataset can have many views defined simultaneously, and the data needed by the client defines which view is used. There are two (2) main uses for views in the client services. In the case of reading records from a dataset, the view defines the set of fields the client wants the server to return for each record read. In the case of writing records from a dataset, the view defines the set of fields the client must send to the server for each record written.

DDM stands for device and data management and refers to a (set of) client and server computer(s) that contain a large set of data relating current documents and past documents, along with tools to allow management of this data. The database server computer will never serve file or print services, as its only purpose is to provide data services through a suite of applications. These applications will be network communication based.

One feature of the present invention is termed the client developers kit (CDK). It is an application programming interface which allows a client to be developed using any platform that has an *Interbase*™ client library available. The client developers kit application programming interface gives access to data of interest without having to know about or understand the details of the database.

Mail piece tracking refers to, inter alia, a client's ability to report the disposition of a mailpiece without necessarily being able to use the database driven insertion data defined in a record. This feature can be used for reprint generation and for generating manifests.

Database driven insertion and processing data file (process directive file) are terms referring generally to the concept of having a electro-mechanical piece of equipment (an inserter, for example) associate large amounts of data with a small "key" or identifier printed on the material via codes (or other machine readable method). The data referred to by the "key" is changeable up to the moment the data is read and "placed" on the equipment. The data can supply (but is not limited to) address information for printing on envelopes, which inserts to drop on this individual account, whether this account should be stapled, etc. Of particular interest is a small piece of the data that allows inserts to be targeted to accounts individually.

The term "stream" relates to input devices, such as continuous forms cutters and cut sheet feeders on a mail processing inserter. For instance, a mail processing inserter with two cutters and one sheet feeder is deemed to have three (3) streams. Hence, streamSheet01, streamSheet02, and streamSheet03 in the data file fields are filled. By convention, the most "upstream" mail processing device is said to be stream 1.

Another feature of the present invention is its ability to provide for duplicate checking. As the client inserter "finishes" each mailpiece, the disposition of the mailpiece is saved in the data file data set via the data file account ID. The database driven insertion client can now provide real-time duplicate checking for the client inserter. If any other machine on the network has processed or is currently processing the mailpiece in question, the "latest" copy of the mailpiece will be deemed duplicate. A warning message will print on the client computer screen, and the mailpiece will be targeted for the reject bin.

It always has been and will always be possible for a printer operator or other worker(s) on the mailroom floor to introduce duplicate copies of already existing material into the processing environment. To detect and remedy these problems as soon as possible, the data file (IDF) system includes real-time duplicate checking software. Overall, there should be no instances where the data file system does not detect a duplicate account. In nearly all cases, it will detect and reject them in real-time. In some cases where duplicate accounts are being processed within one (1) minute of each other on different inserters within the same network, the system will not be able to warn the operator of the duplicate until the second of the duplicate accounts exits the machine.

When two or more machines process the same data with overlapping material the printer operator backs up the print job between stacks of paper. Database driven insertion clients would not be able to detect these errors by themselves, since the account sequencing information would be correct. Depending on how close in time the various mail processing machines processed the material, this case would be caught either by the "Server Reads Data" case or the "Server Writes Data" case.

Should a stack of material on a single machine have duplicate material (from a printer rollback, for example) in the middle of the stack, the database driven insertion client would catch the first duplicate, because the account sequence there would be invalid. If more than one account were duplicated, however, the rest of the accounts would process normally. Duplicate checking detects this problem in the "Client Receives Data" case, the "Server Reads Data" case, or the "Server Writes Data" case, depending on the timing.

In the "Server Reads Data" case, when the server receives a request for an account record, it checks the final destination field of that record. If it is 'NP' (not processed), 'OR' (operator removed), or 'R2' (reject bin), the server changes nothing and passes the data record down to the client for processing. If the final destination is anything different than those mentioned above, the server sets the target destination of the account to 'DP' (duplicate), which will result in the account being sent to the reject bin. The client, whenever it receives a 'DP' target destination, can inform the operator that a duplicate account will be rejected.

In the "Server Writes Data" case, when the server receives data back from the client to write into the data file database, it will know whether the record in the database has been modified. If it has been modified, the server checks to see if the final destination is set to an invalid destination. If it is, it will set the final destination of the record to 'DP' (duplicate), and send a message to the client to inform the operator that a duplicate mailpiece exists.

In the "Client Receives Data" case, when the client receives a record from the server, it checks all the accounts that it is currently processing. If it finds a matching account,

it will set the target destination of the new duplicate account to 'DP'. This account will eventually go to the reject bin.

The abbreviations used in the tables below are explained defined as:

SH	Standard Handling (The destination(s) for "Good" mailable mail).
SD	Security Divert. (The destination(s) for "Special" mail)
OW	Overweight Divert. (The destination(s) for material that is too heavy or too thick to be mailed).
RX	Reject Divert. (The destination(s) where "bad" or damaged material is sent).
OR	Operator Removed. (The destination where material that is removed by the operator is sent).
NP	The initial or Not Processed destination. This flag indicates the mailpiece must be recreated.
DP	Duplicate Account. This indicates that the account was processed at least twice (i.e. more than one copy of this account went to 'SH', 'SD', or 'OW').
LH	Late Hold. This indicates that the user (via a pre-processing function) has determined that the account should not be processed, and wants to require the inserter operator to remove the account from the mailing.

When the client reports a finished account to the server, the server determines the final disposition of the mailpiece by comparing the "current" disposition with the "new" disposition. Based on these two values, it chooses to increment (or not) a value called the "Duplicate Count" (this is the first value in each cell in the table below) and decides whether to save the "new" data into the table (the second value in each cell of the table below). Lastly, the server returns a status for every write, and if the status is affected by the destinations, the status is listed in the third row of each cell. The following table of new and existing final destinations describes the rules governing every possible new and existing final destination:

TABLE 1

		Duplicate Destinations					
		EXISTING FINAL DESTINATION					
	SH	SD	OW	RX	OR	NP	LH
SH	1 No ERR_DUP	1 No ERR_DUP	1 No ERR_DUP	0 Yes ERR_NON	0 Yes ERR_NON	0 Yes ERR_NON	1 No ERR_LH
SD	1 No ERR_DUP	1 No ERR_DUP	1 No ERR_DUP	0 Yes ERR_NON	0 Yes ERR_NON	0 Yes ERR_NON	1 No ERR_LH
OW	1 No ERR_DUP	1 No ERR_DUP	1 No ERR_DUP	0 Yes ERR_NON	0 Yes ERR_NON	0 Yes ERR_NON	1 No ERR_LH
RX	0 No ERR_NON	0 No ERR_NON	0 No ERR_NON	0 Yes ERR_NON	0 Yes ERR_NON	0 Yes ERR_NON	0 No ERR_NON
OR	0 No ERR_NON	0 No ERR_NON	0 No ERR_NON	0 Yes ERR_NON	0 Yes ERR_NON	0 Yes ERR_NON	0 No ERR_NON

When data file data is read from the database, if the duplicate count of the record is greater than zero, the final destination is returned as 'DP', regardless of what the actual final destination in the data is. The only exception to this is where the final destination is 'LH'. In this case, the final destination returned is 'LH', regardless of what the actual duplicate count is. The following table delineates these rules:

TABLE 2

		Duplicate Destination Read Rules						
		FINAL DESTINATION						
		SH	SD	OW	RX	OR	LH	NONE
0		SH	SD	OW	RX	OR	LH	NP
>0		DP	DP	DP*	DP*	DP*	LH	DP*

Note that there should never be final destinations OW, RX, OR, or NONE with a duplicate count greater than zero. These cases are handled as data integrity errors.

When a user "fixes" the problem with a duplicate (or Late Hold), the client can call the "Release Duplicate" application programming interface which will decrement the duplicate count, return the current duplicate count and a status code. The table describing these rules is as follows:

TABLE 3

Release Duplicate Actions							
DUPE	FINAL DESTINATION						
COUNT	SH	SD	OW	RX	OR	LH	NONE
<2	ERR_NON DC = 0	ERR_NON DC = 0	ERR_NON DC = 0	ERR_NON DC = 0	ERR_NON DC = 0	ERR_NON DC = 0	ERR_NON DC = 0
>1	ERR_DUP DC_	ERR_DUP DC_	ERR_DUP DC_	ERR_NON DC = 0	ERR_NON DC = 0	ERR_LH DC_	ERR_NON DC = 0

Note that the first item in each cell is the error code. The second is the action to be performed on the Duplicate Count (DC).

The system and methodology of the present invention can be illustrated by way of the following example, which is described for illustrative purposes only and is not intended to be exhaustive of the potential applicability of the present invention.

ILLUSTRATIVE EXAMPLE

Consider an organization that wishes to print and mail a large batch of material to a set of its customers. First, the organization generates print images within a mainframe host computer, for instance. The print images, representing all or part of the mailpiece to be sent, are forwarded to a printer or printers to be printed on documents such as paper sheet articles. Thus, the content to be mailed is converted from electronic image to physical paper ready to be manipulated in a mail processing environment. The mainframe host computer, in this example, also generates database driven

"mode" of the machine, (iii) which inserts are loaded into the mailing machine, and (iv) the methods of stapling, folding, printing, etc. for the machine.

(2) Physically loading the material on the mail processing machine.

(3) If the "Name" of the database driven insertion (DDI) data is not specified on the reader codes, the user must select which set of database driven insertion data to use from the database.

(4) At this point, the machine begins processing the paper, following the "Job Level" instructions contained in the Job Setup, and the "Account Level" instructions contained in the database driven insertion data.

Database driven insertion data for the following eight (8) accounts is generated by host computers and sent to the database server computer. The database server computer stores the data in the following manner:

TABLE 4

Database driven insertion Account Data												
Tray ID	IDF ID	Doc ID	Target Dest	Tray Dest	DPBC	Pull Key	User Field	Proc. Dir	Str 0	Str 1	Str 2	Str 3
4464	160	3643	"SH"	"	"111111"	"0000000056721475"	"0000000056721475"	"NNNNNNNNNNNNNNNNNNNN"	3	0	0	0
	"AA"		"	"	"1111"							
4464	160	3644	"SH"	"	"111111"	"0000000059049304"	"0000000059049304"	"NNNNNNNNNNNNNNNNNNNN"	3	0	0	0
	"AA"		"	"	"1111"							
4464	160	3645	"SH"	"	"111111"	"0000000059038117"	"0000000059038117"	"NNNNNNNNNNNNNNNNNNNN"	3	0	0	0
	"AA"		"	"	"1111"							
4464	160	3646	"SH"	"	"111111"	"0000000059052456"	"0000000059052456"	"NNNNNNNNNNNNNNNNNNNN"	3	0	0	0
	"AA"		"	"	"1111"							
4464	160	3647	"SH"	"	"111111"	"0000000059691501"	"0000000059691501"	"NNNNNNNNNNNNNNNNNNNN"	3	0	0	0
	"AA"		"	"	"1111"							
4464	160	3648	"SH"	"	"111111"	"0000000057681793"	"0000000057681793"	"NNNNNNNNNNNNNNNNNNNN"	3	0	0	0
	"AA"		"	"	"1111"							
4464	160	3649	"SH"	"	"111111"	"0000000059307249"	"0000000059307249"	"NNNNNNNNNNNNNNNNNNNN"	3	0	0	0
	"AA"		"	"	"1111"							
4464	160	3650	"SH"	"	"111111"	"0000000058294141"	"0000000058294141"	"NNNNNNNNNNNNNNNNNNNN"	3	0	0	0
	"AA"		"	"	"1111"							

55

insertion data that is forwarded to the organization's mail-room database server. The database driven insertion data is then inducted or imported into the database driven insertion and mail piece tracking system.

After the material has been printed and the data has been populated into the database, the mail processing machines begin processing the printed material. An operator of the mail processing machine initiates the following process:

- (1) Selecting and loading a "Job" for the machine. The job is defined in the database and was created previously by a user with authority and privilege to do so. The job defines (i) reader codes printed on the material, (ii) the

The above table data is defined as follows:

Tray ID	Information about the mailing tray the mailpiece belongs to.
IDF ID	The IDF data group this mailpiece belongs to. Generally, an IDF corresponds to a print run.
Target Dest	The desired "destination" of the mailpiece on the mailing machine. This would correspond to "SH" (Standard Handling), "SD" (Security Divert), "OW" (Overweight).
Tray Dest	Information necessary to print a tray tag.

-continued

DPBC	(Delivery Point Bar Code.) Information necessary to print the Postnet Barcode on the mailpiece.
Pull key	Customer Defined key to look up a particular mailpiece.
User Field	Customer Defined key for customer use.
Proc Dir	Processing Directives give instructions to the machine regarding whether to Staple, Seal, Drop Inserts, etc on this particular mailpiece.
Str O-Str 3	Page count information for up to three (3) streams of material. Note that these mailpieces only have pages from stream O.

Print and Verify String Data for these mailpieces appears as follows:

Print String Data

Insert Verify String Data

As the processing of the material progresses, the machine begins to send mailpiece tracking data back to the database. The data sent back for the accounts listed above could, for example, appear as follows:

TABLE 5

Returned Mailpiece Tracking Account Data														
Fin. Dest	Start Time	Finish Time	Shift ID	Job ID	Weight	Postage	Key Line	Status	Dest Rsn	Inserts Fed	Seq Num	Doc ID	IDF ID	Dup Count
"SH"	10/21/1998 17:49:47	10/21/1998 17:51:07	3	821	251	" "	" "	0	1	"000"	"3"	3643	160	0
"SH"	10/21/1998 17:49:47	10/21/1998 17:51:07	3	821	251	" "	" "	0	1	"000"	"4"	3644	160	0
"SH"	10/21/1998 17:49:47	10/21/1998 17:51:07	3	821	251	" "	" "	0	1	"000"	"5"	3645	160	0
"SH"	10/21/1998 17:49:48	10/21/1998 17:51:07	3	821	251	" "	" "	0	1	"000"	"6"	3646	160	0
"OR"	10/21/1998 17:49:47	10/21/1998 17:51:07	3	821	251	" "	" "	0	546	"000"	"0"	3648	160	0
"R2"	10/21/1998 17:51:16	10/21/1998 17:52:36	3	821	251	" "	" "	0	546	"000"	"0"	3649	160	0
"SH"	10/21/1998 17:51:16	10/21/1998 17:52:36	3	821	251	" "	" "	0	1	"000"	"7"	3650	160	0

The data for table 5 is defined as follows:

Final Destination	The location the mailpiece ended up in on the machine.
Start Time	The time the mailpiece began processing on the machine.
Stop Time	The time the mailpiece exited the machine.
Shift ID	The shift the mailpiece was processed on.
Job ID	The Job Instance the mailpiece was processed on.
Weight	The final weight of the mailpiece.
Postage	The final cost of the mailpiece.
Keyline	The keyline printed on the mailpiece (if any).
Status	The final status of the mailpiece.
Destination Reason	The "reason" the mailpiece went to the destination it did.
Inserts Fed	Information about which inserts fed on the mailpiece, and explanations of why.
Sequence Number	The sequence number of the mailpiece.
Document ID	Used to look up/relate DDI data in the previous table.
IDF ID	Used to look up/relate DDI data in the previous table.
Duplicate Count	Used to check for, and signal duplicate accounts.

Table 5 shows that mailpieces 3643, 3644, 3644, 3645, 3646, and 3650 went to destination SH (the "normal"

mailable destination), mailpiece 3647 was never "seen" by the machine (because of a read error, for example), 3648 was OR (operator removed) for reason #546 (possibly a jam or some other problem), 3649 was diverted to the R2 (reject bin) for the same reason (#546). Table 5 also shows that the mailpieces were processed during Shift 3 and JobInstance 821. The database contains detailed information about the processing in the Job and Shift tables.

Once the machine finishes processing the mailpieces, reports are generated that show which mailpieces were successful, which need to be reprinted, etc. The reports are fed back into the system to start another print run.

The present invention provides several advantages over prior art systems and methods. First, all types of data stored in the database driven insertion server are related to the other types of data in a way that makes generating very flexible and detailed reports very easy.

Second, since instructions about each mailpiece are stored in the database, the instructions can be modified right up until the time the mailpiece is placed on a machine for processing. This is sometimes referred to as late binding.

Third, since all mail piece tracking data is kept in the database, one of the reports that can be generated is a standard postal manifest that details all pieces processed and the amount owed the post office. This is sometimes referred to as machine based manifesting.

Fourth, since the mail piece tracking data tracks all mailpieces processed properly and all mailpieces processed improperly, a list of mailpieces to re-produce is easy to produce. This is sometimes referred to as reprint generation.

Fifth, the database contains a physical description (including a scanned image) of all materials to be used in the mailroom. This includes inserts, envelopes, and sheets (of paper). No other mail processing implementation known to the inventors has the ability to show an image of the insert/envelope selected. This feature reduces operator errors by showing the operators pictures of the materials they should be loading into the machine. This is sometimes referred to as centralized materials data.

Sixth, the database contains information about all the machines connected to it and the instructions to the machines for each job. Thus, there is no need to program each machine separately. This is sometimes referred to as centralized job programming.

Seventh, the database contains a list of all defined "bar-codes". When the user programs a job, he/she has the option of creating a new "barcode" map, or selecting one of the

13

already defined ones. There is no need to program the reader map on each individual machine. This is sometimes referred to as centralized reader code map programming.

Eighth, since all mail piece tracking data is in the same database, production reports can be easily generated to show relationships between different machines, operators, shifts, and jobs. This is sometimes referred to as centralized production/efficiency reports.

Ninth, since the mail piece tracking data tells which inserts all fed for each account, and contains the physical descriptions of the inserts, a report detailing the chargeback amounts can be produced. This is sometimes referred to as centralized inserts chargeback reports.

Tenth, descriptions of each user and each user's allowed privileges is kept in the database, and is managed from a single application. This allows management of all operators/users in the mailroom from one central location. This feature allows some (well trained) users to have privileges to perform in certain actions with the equipment that other (less well trained) operators would not. The allowed privileges for each user/operator is managed completely by the customer. This is sometimes referred to as centralized user privilege management.

Eleventh, descriptions of each machine are kept in the database. This allows programs like Job Setup to ask questions pertinent only to the machines the job is intended for. It also allows easy access to information about each machine without having to look at the machine computer itself. This is sometimes referred to as centralized machine definition.

Twelfth, the database contains a master event log that contains all events that may be of interest to a user/customer. These events include (but are not limited to) Machine Starting, Machine Stopping, User Logged In, User Logged Out, Job Started, Job Ended, Shift Started, Shift Ended, Job Created, Job Deleted, Job Modified, etc. This is sometimes referred to as a centralized event log.

Appropriate computer program code in combination with hardware implements many of the elements of the present invention. This computer code is often stored on storage media. This media can be a diskette, hard disk, CD-ROM, or tape. The media can also be a memory storage device or collection of memory storage devices such as read-only memory (ROM) or random access memory (RAM). Additionally, the computer program code can be transferred to the appropriate hardware over some type of data network.

The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. For instance, the architecture described herein is easily extendible to manage processes not normally associated with the mailroom. Some of these processes include direct billing over the internet, print on demand, archiving collections of documents to a CD-ROM, etc.

In the claims, any means-plus-function clauses are intended to cover the structures described herein as performing the recited function and not only structural equivalents but also equivalent structures. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are

14

intended to be included within the scope of the appended claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

That which is claimed:

1. A system for managing database mailpiece processing comprising:

(a) a server computer including a database comprising a plurality of records including instruction sets for handling individual mailpieces;

(b) at least one reader for reading key code marked mailpieces each key code corresponding to one instruction set of the instruction sets in the database; and

(c) a client computer, responsive to the reader, for requesting the instruction set for handling a mailpiece corresponding to a key code on the mailpiece as the key code is read and causing performance of at least one mail processing task in accordance with the instruction set, the client computer immediately updating the record in the server computer database corresponding to the mailpiece being processed as the at least one mail processing task is performed to indicate the status of the mailpiece and track the mailpiece in real time.

2. The system of claim 1 comprising a supervisor computer coupled to the server computer for generating at least one report concerning the performance of at least one mail processing task.

3. The system of claim 2 wherein the supervisor computer requests mailpiece tracking data from the server computer and generates at least one report concerning the tracking of at least one mailpiece.

4. The system of claim 3 in which the at least one report is a postal manifest report.

5. The system of claim 1 wherein the database comprises stored instructions about each mailpiece and wherein the instructions are modifiable at any time prior to performance of a mail processing task utilizing the instructions.

6. A system for managing database driven insertion and mailpiece tracking data comprising:

(a) a server populating a database with data comprising a plurality of records including instruction sets for handling individual mailpieces;

a reader for reading, from a mailpiece, a key code corresponding to a database location containing an instruction set for handling the mailpiece;

(c) a client, responsive to the reader, for requesting the instruction set for handling the mailpiece from the server, such that the server receives the request from the client, accesses the instruction set for handling the mailpiece and forwards the instruction set to the client;

(d) a mail processing device coupled to the client for performing at least one mail processing task on the mailpiece in accordance with the instruction set; and

(e) means, responsive to the mail processing device, for immediately updating a record in the database corresponding to the mailpiece being processed.

7. The system of claim 6 further comprising means for generating at least one report concerning the performance of at least one mail processing task.

8. The system of claim 6 further comprising means for generating at least one report concerning the tracking of at least one mailpiece.

9. The system of claim 8 in which the at least one report is a postal manifest report.

10. The system of claim 6 in which said database may be populated with new data anytime prior to performance of a mail processing task utilizing said data.

15

11. A method for managing database driven insertion and mailpiece tracking data comprising:

- (a) populating a database with data comprising a plurality of records including instruction sets for handling individual mailpieces;
- (b) reading, from a mailpiece, a key code corresponding to an instruction set for handling the mailpiece; requesting the instruction set for handling the mailpiece from the database;
- (d) at a server:
 - (i) receiving requests from one or more clients for instruction sets for handling individual mailpieces and, in response, accessing the requested instruction set for handling the mailpiece from the database; and
 - (ii) forwarding the requested instruction set to the one or more clients; and
- (e) at a client:
 - (i) receiving the requested instruction set for handling the mailpiece from the server;
 - (ii) performing at least one mail processing task in accordance with the requested instruction set;
 - (iii) gathering mailpiece tracking data as the mailpiece is processed during said at least one mail processing task; and
 - (iv) immediately updating a record in the database corresponding to the mailpiece being processed.

12. The method of claim 11 further comprising generating at least one report concerning the performance of at least one mail processing task.

13. The method of claim 11 further comprising generating at least one report concerning the tracking of at least one mailpiece.

14. The method of claim 13 wherein the at least one report is a postal manifest report.

15. The method of claim 11 comprising modifying the instructions in the database immediately before accessing the database to retrieve the instructions.

16

16. A client/server system for managing mail processing and mailpiece tracking data, the system comprising:

- (a) a database server computer comprising a central repository for mail processing data including instruction sets for processing individual mailpieces and mailpiece tracking data for tracking the individual mailpieces;
- (b) a machine client computer for requesting one of the instruction sets for processing an individual mailpiece from the database server computer based on account information read from a mailpiece and for transmitting updates to the database server computer in real-time as the mailpiece is processed;
- (c) a supervisory computer for communicating with the database server computer and the machine client computer to allow users to determine status and location information relating to mailpieces being processed; and
- (d) a network for linking the database server computer, the machine client computer, and the supervisory computer.

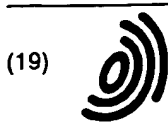
17. The client/server system of claim 16 wherein after processing of the account has been completed, the supervisory computer generates a manifest indicative of the processing of the account.

18. The client/server system of claim 16 comprising a mainframe computer coupled to the network for sending mail processing data to the database server computer.

19. The system of claim 16 wherein the database server computer is adapted to display a scanned image of the mailpiece being processed.

20. The system of claim 16 wherein the database server computer is adapted to allow late binding of the account information from the mailpiece to one of the instruction sets.

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European Patent Office
Office européen des brevets



(11) EP 1 219 469 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.07.2002 Bulletin 2002/27

(51) Int Cl.7: B43M 5/04

(21) Application number: 01205111.6

(22) Date of filing: 28.12.2001

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

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(54) Production of mail pieces and preparations therefor

(57) For producing mail pieces in a mail production apparatus, starting from physical postal items, a required operating condition of the mail production apparatus is determined. At least one physical property to be realized manually of the required operating condition is determined and at least one current physical property of a current condition of the mail production apparatus is registered. A difference between the at least one current physical property and the at least one physical prop-

erty to be realized manually of said required operating condition is determined and an associated indication is represented in humanly perceptible form. In response, the at least one current physical property is changed, such that the difference is removed. Next, with the mail production apparatus in the required operating condition, at least one mail piece is assembled from physical postal items. Also described are computer software and an apparatus for use with this method.

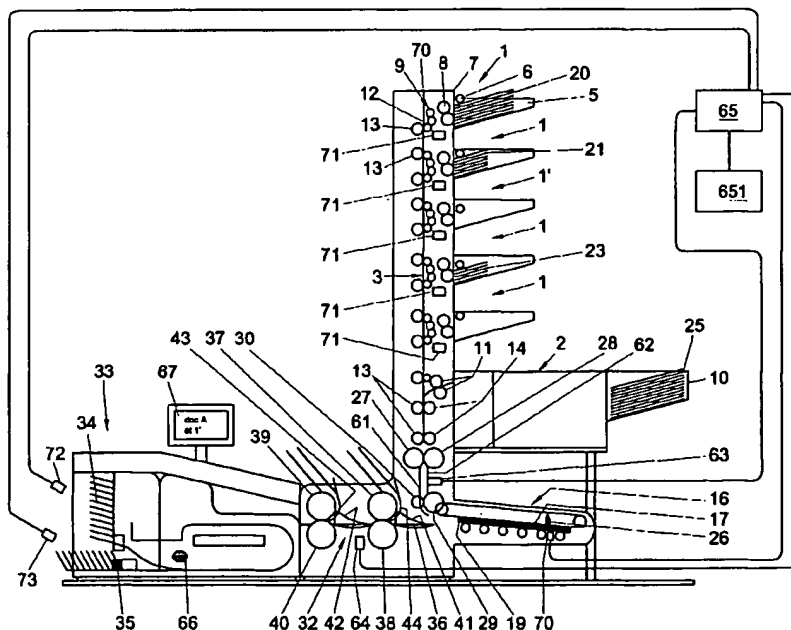


Fig. 1

Description

[0001] The invention relates to a method and an apparatus for producing mail pieces in a mail production apparatus, starting from physical postal items. The invention further relates to a computer program for programming an apparatus for practicing such a method.

[0002] Mail production apparatuses known from practice, of the Neopost SI-72 type, are arranged for indicating what paper lengths for producing mail pieces under a particular system setting need to be present in which feeder stations.

[0003] However, due to the mail producing apparatuses being frequently operated by temporary personnel with little experience, the problem occurs that during the preparations of the mail producing apparatus prior to the production of a mail piece or, as is more usual, a series of mail pieces under a predetermined system setting, problems arise in that the operator fails to see what needs to be done to bring the apparatus in the required condition of use, or makes mistakes.

[0004] The invention has for its object to provide a method whereby preparing a mail production apparatus is simplified and the chance of errors is reduced. To that end, the invention provides a method according to claim 1. As at least one physical property of the required operating condition that is to be manually realized is determined; at least one current physical property of a current condition of the mail production apparatus is registered; a difference between the at least one current physical property and the at least one, only manually realizable property of the required operating condition is determined; and an indication associated with the difference is represented in humanly perceptible form, the operator of the production apparatus does not himself need to determine the settings to be changed, but he can simply see what differences there are between the current condition of the apparatus and the required operating condition of the apparatus, or at least which actions are to be performed for bringing the mail production apparatus from the current condition into the required operating condition.

[0005] The invention further provides a computer program according to claim 9. In accordance with such a computer program, a mail production apparatus can be controlled for practicing the method according to the invention.

[0006] The invention further provides an apparatus according to claim 11, which is specifically arranged for practicing the method according to the invention.

[0007] Particularly advantageous embodiments of the invention are laid down in the depending claims.

[0008] Further details and aspects of the invention will be discussed with reference to the figures shown in the drawing.

[0009] Fig. 1 is a cutaway schematic side elevation of a system according to an exemplary embodiment of the invention.

[0010] Fig. 2 is a flow diagram representing an example of a method according to the invention.

[0011] In the following, the invention will be further elucidated on the basis of the example of an apparatus according to the invention shown in Fig. 1.

[0012] The apparatus shown in Fig. 1 has a finishing assembly for producing mail pieces. The finishing assembly is equipped with a number of feeder stations for feeding documents. In the apparatus, these are designed as document feeder stations 1 for feedings documents 20, 21, 23. The apparatus further comprises a printer 2 for printing sheets 25 and feeding printed sheets, and envelope feeder stations 34, 35 for feeding envelopes.

[0013] The first feeder stations 1 are designed as document feeder stations. Each of the document feeder stations 1 has an associated tray 5 for holding insert documents to be supplied. For feeding the inserts, the feeder stations 1 are each provided with a feed roller 6, a separation roller 7, a transport roller 8 and a pair of delivery rollers 9. An example of a separation provision suitable for use in feeder stations 1 according to the exemplary embodiment shown is described in more detail in U.S. patent specification 5,362,037, which is hereby referred to.

[0014] A position of the finishing assembly designated 1' is empty, apart from delivery rollers serving for feed-through of documents which are to be passed from upstream feeder stations along that position 1'. At this position 1', for instance the same feeder station as the feeder stations 1 can be placed, but also a special feeder station or a station for carrying out special operations, such as stamping passing documents or providing these with a sticker, a sachet or a plastic card.

[0015] The printer 2 is provided with a tray 10 for sheets 25 to be printed and a pair of delivery rollers 11 for each time delivering a printed sheet at a suitable moment. The printer 2 is further designed and positioned such that the printing of a sheet in each case is completed before the sheet reaches a waiting position between the delivery rollers 11.

[0016] The feeder stations 1 and the printer 2 link up with a feed track 3 having a series of opposite transport rollers 12, 13, 14.

[0017] The apparatus shown further comprises an aligning station 16 for aligning documents belonging to a set and any other postal items, to form a stack having document edges substantially in alignment on one side.

[0018] The aligning station 16 is designed as a terminal station with an aligning surface 19 with a stop 26 and a discharge track 36 in line with the aligning surface 19. Upstream of the aligning surface, the aligning station 16 has transport rollers 27, 28, 29, 30 and guides 61, 62. The aligning surface 19 is defined by a series of rollers.

[0019] The documents can be transported in the feeding direction as far as against the stop 26 and subsequently be discharged in the opposite direction to a folding station 32. The aligned document edges then form

the trailing edge of the stack, which is advantageous in folding the stack.

[0020] Opposite the aligning surface 19, a conveyor belt 17 is arranged, which runs approximately parallel to the aligning surface 19, can exert some pressure on the aligning surface 19 and has a greater coefficient of friction relative to documents than does the aligning surface 19, which moreover is provided with rollers for further limiting the friction between documents and that surface. By driving the belt 17 in the direction of the stop 26, documents present between the aligning surface 19 and the belt 17 can be urged against the stop 26, so that the document edges are mutually aligned on the side of the stop 26.

[0021] By driving the conveyor belt 17, a document can be moved over the surface 19 as far as against the stop 26. A next document, which has been partly passed between the preceding document and the conveyor belt 17, will, moving over the preceding document, likewise move as far as against the stop 26 when the belt 17 is driven in the direction of the stop 26. Thus, successive documents can be aligned.

[0022] The folding station 32 is provided with a first and a second pair of folding rollers 37, 38 and 39, 40, with the discharge track 36 extending between the folding rollers 37, 38 and 39, 40. Provided between the stop 26 and the folding rollers 37, 38 and 39, 40, respectively, are deflectors 41 and 42 for deflecting the edge of a stack remote from the stop 26. Arranged opposite a folding nip between each pair of folding rollers 37, 38 and 39, 40 is a folding knife 43, 44 for pressing a deflected portion of a document or a stack of documents into the folding nip.

[0023] After alignment of the documents of a stack in the aligning station 16, the stack is first moved against the feeding direction and then to the folding station 32, whereby, at least if the stack is to be folded, the edge of the stack remote from the stop 26, and a portion of the stack contiguous thereto, is deflected along a pair of folding rollers 37, 38 or 39, 40 and the stack is subsequently pressed into a folding nip between the folding rollers 37, 38 or 39, 40 by one of the folding knives 43, 44. Thereupon the folding rollers are driven, so that a fold is provided in the stack.

[0024] A folding station and folding method of the type as described hereinabove are described in more detail in U.S. patent specification 4,985,013, which is hereby referred to.

[0025] Connected to the folding station 32 is an inserter station 33. This inserter station 33 is equipped with two trays 34, 35 for envelopes. What can serve as a basis for such an inserter station is an inserter station described in more detail in the European patent application having publication no. 0781671. The inserter station has an envelope track 4 and an exit 18 for packaged mail pieces.

[0026] At the beginning of the setting and production operation represented in Fig. 2, first, in a setting phase,

during a selection step 100, one or more properties of the finishing assembly are determined which are associated with the series of mail pieces to be produced. These can be, for instance: the inserts 20, 21, 23 needed for the mail pieces, and their positions, the required type of sheets 25 to be printed, required type(s) of envelopes, the number of required feeder stations, the settings of the folding station, the position of the stop 26, the presence of special stations at the position 1', the presence of a franking unit, etc.

[0027] The properties can have been priorly determined and subsequently stored in a memory 651 linked with a control unit 65 of the finishing assembly. At the start of the operation, a set of properties (also referred to as job setting) that apply to the production of a mail piece or, as is more usual, a series of mail pieces, is selected from the memory by a user. If the properties of the finishing assembly for the kind of mail piece to be produced have not been priorly determined, the properties can, after being inputted, be stored in the memory 651, so that in a next production operation of the same kind-of mail pieces the data regarding the required set of properties can be readily retrieved again. Determining the properties of the finishing assembly that are desired for a series of mail pieces and inputting the data involved in the memory can be done by third person, not being an operator, for instance a technician of the manufacturer or a specially trained employee.

[0028] After a set of properties has been established, the control unit 65, in determining step 101, determines the physical properties thereof that are to be changed manually. It will be clear that automatically modifiable properties of the finishing assembly can be automatically modified under the control of the control unit 65. The properties to be modified manually, however, must be adapted by the operator. Automatically modifiable properties are known per se and are therefore not discussed for the sake of brevity. The properties to be changed manually can be, for instance: the types of document that must be present in the respective feeder stations 1, the presence of a particular type of station at the position 1' and downstream of the inserter machine 33, the size of the sheets 25 to be printed, the position of the stop 26 and the kind of envelopes that must be present in the envelope feeder stations 34, 35.

[0029] After determination step 101, the control unit 65, in step 103, determines the difference between the selected manually modifiable properties and current properties of a current condition of the finishing assembly. To that end, first, in step 104, the current properties of the current condition of the finishing assembly are registered. To that end, the apparatus is provided with sensors 63, 64, 70-73 linked with the control unit 65, which sensors can measure the quantities relevant for the respective property and, on the basis thereof, can provide signals that represent the respective properties to the control unit 65. As a result, the control unit 65 can determine the difference between the current condition

and the required properties.

[0030] It is also possible, however, to determine the current properties relying on the set of properties that applied to the preceding production operation (step 102). The data regarding the set of properties that applied during the preceding production operation are stored in the memory 651 and can be retrieved therefrom by the control structure 65 and be compared with the properties determined. Determining the difference between the current condition and the required properties can thus also be done without actual observations, so that sensors can be saved.

[0031] For determining postal items present in the feeder stations 1 and sheets present in the printer 2, a scanner 63 is arranged along the transport track 3, downstream of the feeder stations 1 and the printer 2. The stations 1 and the printer are controlled one by one to feed an item, and these are scanned by the scanner 63. Thus, only one scanner can suffice for scanning items from all stations 1 and the printer 2. For observing envelope types in stations 34, 35, sensors 72, 73 are provided. In the embodiment shown in Fig. 1, the sensors 72, 73 are designed as digital cameras which can make a recording of the upper side of a stack of envelopes. The recording made by the cameras is then inputted into the control unit 65 and compared with images of postal item types as stored in the memory 651, so that the item type present can be determined and compared with the item type according to the required properties.

[0032] In Fig. 1, further sensors 71 in the form of connections with several electrical contact points are placed which can each detect the presence of a feeder station in the respective position and, on the basis of a signal received via the contact points, can further identify the type of feeder station. At the stop 26 a sensor 70 is present which detects the position of the stop, and the folding station is provided with a detector which can detect the position of deflectors 41, 42.

[0033] After in step 103 the difference between the required properties and the current properties has been determined, the difference determined is represented in representation step 105. Such representation can be done in any humanly perceptible form. According to this example, the difference is represented on a display 67. It is also possible, however, to provide the control structure 65 with a speech module and to communicate the difference to the operator by way of speech via a loudspeaker 66. Communication to the operator is then also possible without the operator being in the immediate vicinity of the display 67, which enables faster filling of the trays 5, 10, because the operator does not need to look at the display all the time. As the difference between the current condition and the properties to be changed is displayed, the operator can readily see what operations he must perform to bring the apparatus in the condition required for the mail piece to be produced. The operator thus does not himself need to determine the differences

and the operations to be performed, but only needs to adjust the differences displayed, so that the risk of errors is reduced. As performing manual settings is thus simplified, also the necessity of automatic setting is rendered less urgent. As a consequence, without serious disadvantage, actuators for automatic setting can be saved upon.

[0034] The finishing assembly, depending on the setting of the finishing assembly selected by the operator, can also determine which operations are to be performed for removing the differences established in step 103 (step 106) and display the operations to be performed (step 107). A combination of representation step 105 and determining and representing the operations to be performed is also possible. In that case, for instance, the difference is depicted on a display in the form of an image of the apparatus with the differences highlighted and the operations to be performed represented in a table next to the image.

[0035] It is also possible in each case to represent only a portion of the operations to be performed in the step 107 and subsequently, in a step 108, to determine whether any further operations are to be performed and, if so, to represent a next one of residual operations. As a result, it is checked in each case whether the operator has performed the operation, or at least has reported it as performed, and the operator only needs to remember and perform the step represented.

[0036] The operator's chief actions are filling the feeder stations 1 and the envelope feeder stations 34, 35 with the correct postal item types, such as documents, inserts and envelope types. To prevent errors in this regard, in representing the operations to be performed, the item types to be loaded can be represented. To further reduce the risk of errors, also the feeder station where a specific document type is to be entered can be represented. Such representation can be effected, for instance, by depicting a property of the item type on the display 67. This property can be, for instance, the appearance of the front of the document, a title of the document, an identification code of the document, the size of the document or the kind of paper of the document.

[0037] After difference step 103 and the representation step 105 and/or steps 106, 107 have been carried out, the current properties, as far as necessary, can be modified into the required properties, and with the production apparatus mail pieces can be produced with the system settings determined.

Claims

1. A method for producing mail pieces in a mail production apparatus, starting from physical postal items, comprising:

selecting a required operating condition of the mail production apparatus applying to the pro-

- duction of at least one mail piece;
determining at least one physical property to be realized manually of said required operating condition;
registering at least one current physical property of a current condition of said mail production apparatus;
determining a difference between said at least one current physical property and said at least one property to be realized manually of said required operating condition;
representing an indication associated with said difference in a humanly perceptible form;
manually changing said at least one current physical property, such that said difference is removed; and
composing said at least one mail piece from physical postal items with said mail production apparatus in said required operating condition.
2. A method according to claim 1, wherein at least one property of said current condition is determined by determining at least one property of a directly preceding operating condition.
3. A method according to claim 1 or 2, further comprising:
determining operations to be performed manually for bringing said mail production apparatus from said current condition into said required operating condition; and
representing said operations to be performed manually in a humanly perceptible form.
4. A method according to claim 3, further comprising:
each time after an operation has been performed, again registering the current condition of said mail production apparatus; and
representing in humanly perceptible form at least one residual operation of said operations to be performed.
5. A method according to any one of the preceding claims, further comprising:
determining types of physical postal items associated with said required operating condition;
registering physical postal items loaded into said mail production apparatus;
determining a physical postal item type of said loaded physical postal items; and
determining a difference between types of physical postal items associated with said required operating condition and said types of loaded physical postal items;
- wherein representing said difference comprises representing at least one type of physical postal items to be loaded.
6. A method according to claim 5, further comprising representing at least one loading position for physical postal items of said at least one type that are to be loaded.
7. A method according to claim 5 or 6, wherein representing said at least one type of physical postal item types to be loaded is carried out by representing a property of physical postal items of said at least one type that are to be loaded.
8. A method according to any one of claims 5-7, wherein loaded physical postal items are registered by said mail production apparatus by scanning and registering a property of each of the types of loaded physical postal items.
9. A computer program for supporting manual preparatory operations for operationalizing a mail production apparatus, comprising instructions for:
determining data regarding a required operating condition applying to the production of at least one mail piece;
determining at least one physical property to be realized manually of said required operating condition;
registering at least one current physical property of a current condition of said mail production apparatus;
determining a difference between said at least one current physical property and said at least one property to be realized manually of said required operating condition; and
causing an indication associated with said difference to be represented in humanly perceptible form.
10. An information carrier provided with machine-readable data constituting a computer program according to claim 9.
11. A mail production apparatus for producing mail pieces, starting from physical postal items, comprising:
at least one finishing assembly for producing physical mail pieces;
a sensor for registering a current physical property of a current condition of said at least one finishing assembly;
representation means; and
a control structure communicatively linked with said finishing assembly, said sensor and said

representation means, said control structure being provided with code for:

determining data regarding a required operating condition applying to the production of at least one mail piece;
 determining at least one physical property to be realized manually of said required operating condition;
 registering at least one current physical property of a current condition of said finishing assembly;
 determining a difference between said at least one current physical property and said at least one property to be realized manually of said required operating condition;
 causing an indication associated with said difference to be represented by said representation means; and
 causing said at least one mail piece to be composed by said finishing assembly in said operating condition.

12. An apparatus according to claim 11, further comprising a memory structure communicatively linked with said control structure for storing data which represent a directly preceding operating condition, wherein said control structure is further arranged for determining at least one property of said current condition by determining at least one property of said directly preceding operating condition.
13. An apparatus according to claim 11 or 12, wherein said control structure is further arranged for determining operations to be performed manually for bringing said finishing assembly from said current condition into said required operating condition and representing said operations to be performed with said representation means in humanly perceptible form.
14. An apparatus according to claim 13, wherein said control structure is further arranged for registering the current condition again after the performance of one of said operations to be performed, and representing in humanly perceptible form at least one residual operation of said operations to be performed.
15. An apparatus according to any one of claims 11-14, further comprising an item sensor communicatively linked with said control structure, for registering loaded physical postal items, wherein said control structure is further arranged for determining physical postal item types associated with said required operating condition, registering loaded physical postal items, determining at least one type of said loaded physical postal items; and representing at

least one type of physical postal items to be loaded.

16. An apparatus according to claim 15, wherein said control structure is further arranged for representing with said representation means, in addition to the or each type of physical postal items to be loaded, a loading position for physical postal items of that type to be loaded.
17. An apparatus according to claim 15 or 16, wherein said control structure is further arranged for representing a property of physical postal items of said type to be loaded.
18. An apparatus according to any one of claims 15-17, wherein said item sensor is arranged for registering an item property of said loaded physical postal items.

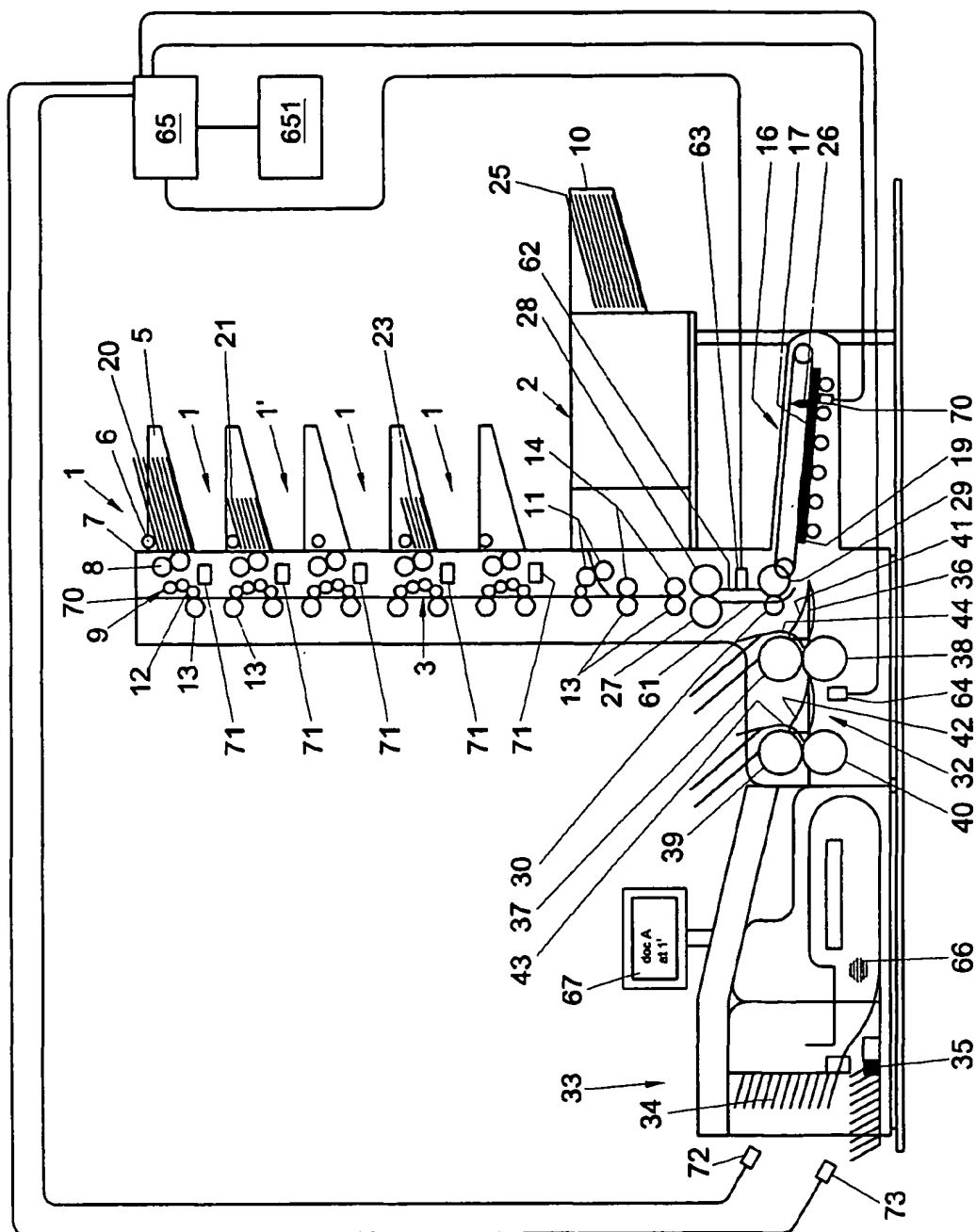


Fig. 1

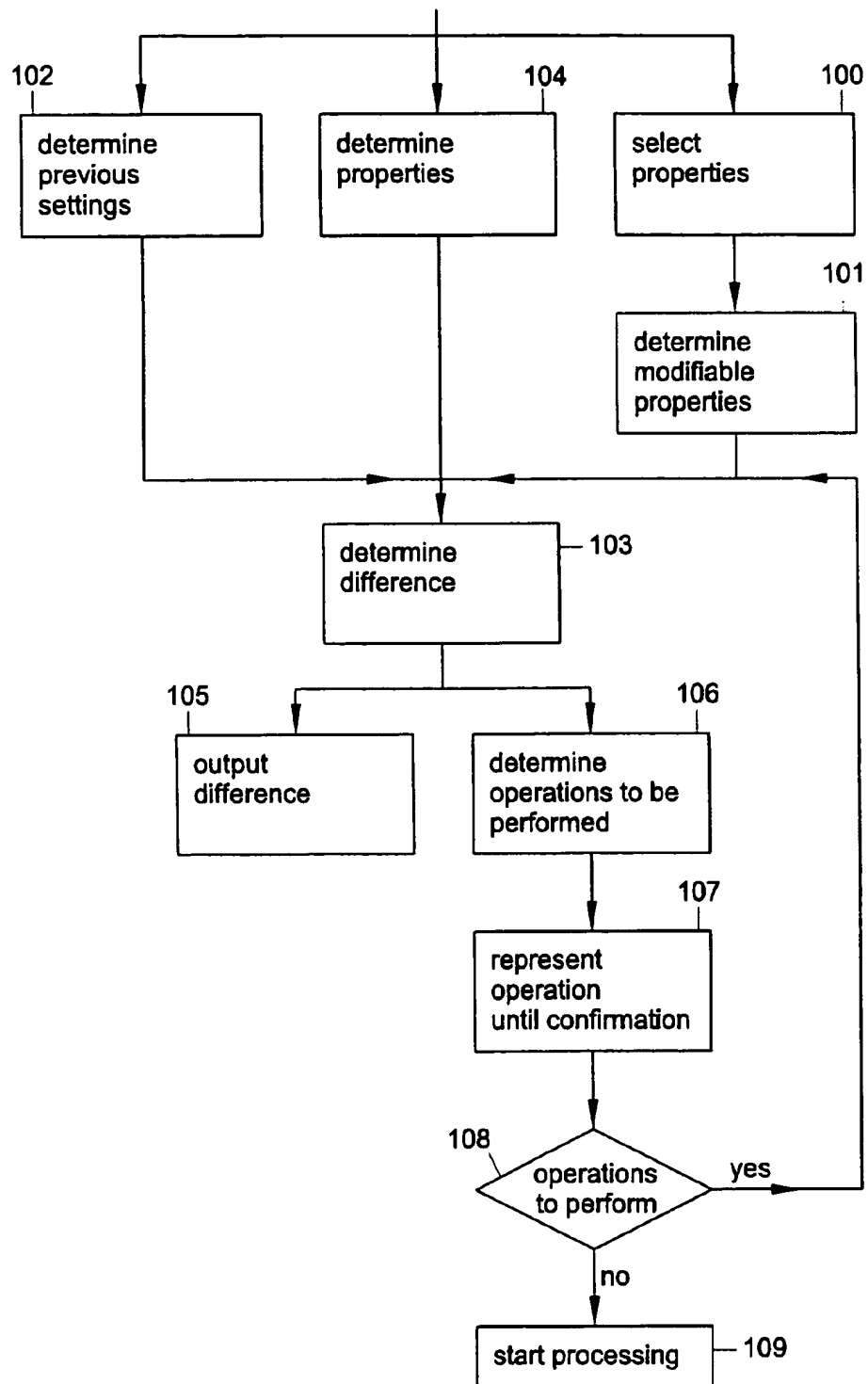


Fig. 2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 20 5111

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (InLCI.7)
A	US 6 032 122 A (GERTNER PATRICIA ANN ET AL) 29 February 2000 (2000-02-29) * column 1, line 40 - column 2, line 23 *	1-11	B43M5/04
A	US 5 956 414 A (GRUENINGER BAPTIST) 21 September 1999 (1999-09-21) * column 2, line 9 - line 38 *	1-5, 11	
A	EP 0 661 176 A (NEOPOST IND) 5 July 1995 (1995-07-05) * abstract *	1, 11	
A	EP 0 768 625 A (OMRON TATEISI ELECTRONICS CO) 16 April 1997 (1997-04-16) * abstract; figure 17 *	1	
A	WO 98 24563 A (DUFFY EDWARD PHILIP; PRINTED FORMS. EQUIP (GB)) 11 June 1998 (1998-06-11) * column 3, line 10 - column 4, line 6 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B43M G07B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 March 2002	Examiner Hinrichs, W
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